

December 21, 1959

Aviation Week

Including Space Technology

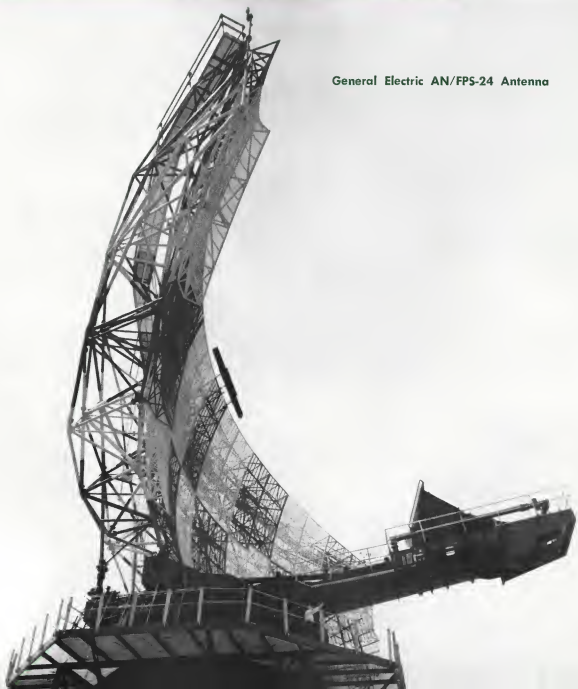
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AVIATION CALENDAR

(Continued from page 5)

Sept. 18-19th-First National Symposium on Nondestructive Testing of Aircraft and Marine Components, Hilton Hotel, San Antonio. TUL Sponsor: Southwest Section, Society for Nondestructive Testing, Southeastern Aircraft Institute.

Mar. 9-11-Conference on the Mechanical Properties of Engineering Composites, North Carolina State College, Raleigh, N. C. Sponsor: North Carolina State College School of Engineering, Office of Aerospace Research, U. S. Army.

Mar. 14-15-National Flight Propulsion Meeting (abstracts), Frontier of the Advanced Sciences, Cleveland, Ohio.

Mar. 15-16-Symposium on Optical Spectroscopy Measurement of High Temperature, University of Chicago, Chicago, Ill. Sponsor: University of Chicago, Applied Science Laboratories, Jervis Ash Co., National Science Foundation.

Apr. 6-8-Structural Design of Space Vehicles Conference, Ritz-Carlton Hotel, Santa Barbara, Calif. Sponsor: American Rocket Society's Structures and Materials Committee.

Apr. 8-10-1968 National Meeting "Hydro Environmental Science Frontiers," Institute of Environmental Sciences, Ritz-Carlton Hotel, Los Angeles, Calif.

Apr. 19-21-1st National Symposium on Airframe Networks and Feedback Systems, Engineering Section Bldg., New York, N. Y. Sponsor: Polytechnic Institute of Brooklyn, Department of Defense Research Agency, Institute of Radio Engineers.

Apr. 18-21-National Symposium on Vibration Space Stations, Frontier of the Advanced Sciences, Ambassador Hotel, Los Angeles, Calif. Cosponsors: NASA, the Rand Corp.

Apr. 21-22-1968 World Metals & Materials Conference: Metals and Materials for Space Age, American Institute of Mining, Metallurgical and Petroleum Engineers, Ambassador Hotel, Los Angeles.

Apr. 29-30-4th Annual Corrosion and Pipelines, American Welding Society, Ritz-Carlton Hotel and Civic Center Exhibit Center, Los Angeles, Calif.

Apr. 27-28-National Meeting on Space Age Materials, Cosponsors: Chapter of the American Society for Metals, Skidmore, Gilman Hotel, Cincinnati, Ohio.

Mar. 31-1968 Symposium of the Institute of Radio Engineers Professional Group on Microwave Electronics and Techniques, Hotel del Coronado, San Diego.

Mar. 9-11-Sixth Southwestern Micro Conference and Exposition, American Society for Metals, Sheraton Hotel, Dallas and State Fair Park, Dallas, Tex.

Mar. 10-12-1968 Electronic Components Conference, Waldorf Hotel, Washington, D. C. Sponsor: Institute of Radio Engineers Professional Group on Composite Parts, American Institute of Electrical Engineers, Electronic Industries Association, Western Electronic Manufacturers Association.



12,500 gallons of liquid nitrogen can be stored and transported by this glass-lined tank container. The vacuum jacketed tank holds liquid oxygen at -260° F with negligible losses. Designed and built by Standard Steel Corporation, San Gabriel, Ala., the tank is used in holding the Air Force Pro Helium plants.



Vacuum Jacketed Tanks Bring New Concepts to Cryogenics

The world's largest airborne vacuum jacketed tank shown above is just one example of how Standard-Cambridge Cryogenic know-how is providing new and improved methods for controlling "hard-to-handle" products. In this field of cryogenics and "liquid logistics" there are many new concepts which can save money and increase safety. Some of these are...



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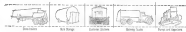
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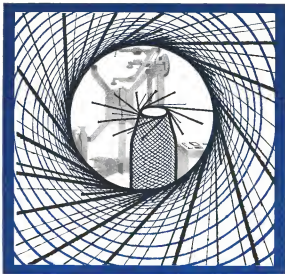


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...FOR AN ARMY ON THE MOVE

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This new capability—swift mobility with pinpoint accuracy—was made possible with Ryan's new navigation systems. The Army's first successful self-contained navigation sets, both for land and rotary wing aircraft.

This advanced electronic navigator was designed and developed by Ryan Electronics under Army contract and tested by the Army Electronics Proving Ground at Ft. Monmouth. Ryan's AN/APN-125(V) navigator is in production for use with the Army AG-1F Mohawk and RL-35D surveillance aircraft, and the Model 125S is guiding H-19 and H-34 helicopters.

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December 21, 1959

Aviation Week

Including Space Technology

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AVIATION WEEK, December 21, 1959

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EDITORIAL

Returning the Triple Crown

The last month of 1959 will have a permanent glow in the history of American aviation as the period when the triple crown of world records—speed, altitude and 100 km closed course—returned to this country from France and the Soviet Union. This feat was accomplished by Air Force and Navy pilots in four different types of combat-ready aircraft that established a truly remarkable envelope of sustained aircraft performance—1,525.9 mph in level flight, 1,216.4 mph around the 100 km closed course and 108,395 ft altitude. Even at the beginning of the "delicious fight" in aircraft development, it would have taken a rare-owned jaeger to risk predicting what has in fact become reality in the first month of the decade.

The altitude record has been the most elusive in this triple crown for U. S. men and machines. It had elapsed about 18 years when USAF Capt Howard Johnson returned it last year with a 91,240 ft score in the Lockheed F-104. Last summer when we visited the Soviet Union for the Federation Aeronautique Internationale conference, Soviet designer Alexander Yakovlev and Sergei Burenko were extremely responsive about the absolute altitude capability of the F-104. The reason for their interest in this subject was most apparent.

Shortly a month after we left the USSR, that country made its first official bid in absolute world record competition with a 94,678 ft altitude mark in a delta-winged jet lighter designated T-43. Apparently some special designation of the Sukhoi delta design that flew in prototype form at the 1958 Tushino air show. This Soviet record duly homologated as official by the FAI stood until early December when a McDonnell F-4H carrier-based Navy fighter piloted by Candi L. E. Felt topped it with a 98,360 ft performance. The Navy mark lasted only a few days before Capt Joe Jordan, a USAF experimental test pilot at Edwards AFB, took his F-104 to 101,395 ft in a new peak. Capt Jordan actually lost 101,080 ft on one run, but sufficient recordings to meet official requirements were not obtained.

The speed record has been more at home in the U. S., although since World War II it has elapsed occasionally abroad. Last month the Soviet Union entered this competition with a 1,494 mph mark, apparently with the same type Sukhoi delta but this time labeled by the Russians as the 136. Although this was an unpublicized mark in Moscow it has not yet been officially filed with the FAI headquarters in Paris. And it will be interesting to see if the Russians really provide the full documentation on the performance required for official records. But, official or unofficial this mark didn't last long either. Earlier this month a modified General F-106A flying at full combat gross weight averaged 1,525.9 mph while piloted by Capt Joe Rogers of USAF Air Defense Command. Capt Rogers is perhaps more familiar to readers of *Aviation Week* as the pilot who flew our veteran pilot-engineering editor Robert Stinfield on a Mach 2 intercept described in our issue of Sept. 7, p. 126. Capt Rogers' 1,525.9 mph average speed was just below Mach 2.4 and was made during less than the best possible weather conditions. With better

weather, the F-106 should be able to push this mark to just over Mach 2.5 and a position from which it should be difficult for anything but a stainless steel aircraft to wrest it. It is interesting to note that the Mach 2.5 capability of a USAF combat aircraft in operational service was demonstrated at about the same time that the British aviation industry disclosed construction of a stainless steel research aircraft designed to explore the speed range just above Mach 2.5 (see p. 22) and indicated first flight of this research aircraft would not take place until next year.

The 100 km closed course record has also moved in Britain and France during the past year, and there has been no attempt yet by the USSR to enter this competition. The 1,216.4 mph performance by Brig. Gen. Joseph H. Moore in a Republic F-105B surpassed the old record held by a French Dassault Mirage 3A. Gen. Moore is commander of the Tactical Air Command 4th Fighter Wing, the first operational unit to be equipped with the F-105 Thunderchief and the subject of a major *Aviation Week* story in our next issue.

As an added flip, the Kazan H-43B turbine-powered helicopter set a class altitude record by helicopter from the Russian Ministry of Defense. It performed and beat the two USAF H-43B helicopters a mere 30 mph groundspeed in the winds near their maximum altitude.

We have long supported keen international competition in all aviation categories as a healthy stimulus to technical advance and a fair measure of international technical prestige. We heartily opposed the policies initiated a few years ago by the then Defense Secretary Charles Wilson that virtually withdrew any modern U. S. aircraft from this type of competition and gave a reliable false international impression of our genuine capability in this field. We believe the Soviet Union to join in this international competition (AW May 12, 1958, p. 21) and have been heartened by their recent willingness to compete. Many people, including our staff, are still puzzled by the continuing designation system applied by the Soviets to their record-breaking military aircraft. It would be a colossal service if they clarified this point or at least released pictures of the record-breaking aircraft so that some common denominator could be established.

The drive is rapidly approaching when these massive masses of sustained vehicle performance will extend out of the atmosphere and into space, posing issues now problem both technical and political. The first, albeit unsuccessful, attempt to tackle these new problems was made by the United States delegation to the FAI conference in Moscow last summer. It is obvious that these attempts must be pursued vigorously if international aerospace competition is not to halt at the limits of the atmosphere.

In the meantime, a hearty salute to the U. S. military pilots who brought the triple crown back to this country and to Lockheed, General and Republic for manufacturing their combat-ready mounts.

—Robert Hertz



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Washington Roundup

Nike Zeus Funds Withheld

Office of the Secretary of Defense is withholding \$157 million authorized by Congress for propagation effort on the Nike Zeus anti-ICBM missile and reportedly has classified the account for the defense to prevent Army from making public protests. Approximately \$15.28 million of the total was scheduled to be used to establish radar-based search lanes for producing the nucleus of ultracoldable ionization, resistors and capacitors needed for Zeus radar and computer (see p. 55, AW Nov. 24, p. 74). At meeting at last June the then-Secretary of Defense Neil McElroy recommended in testimony before the Senate approval of the funds added by the House "to expedite further the Nike Zeus program."

Southern Transcontinental Proposals

Smaller trunklines would reap the greatest benefits if the Civil Aeronautics Board follows the course recommended by bureau counsel in the Southern Transcontinental Service Case. Counsel V. Jack Greenbaum proposed a complex of new routes which would create two new transcontinental routes, and he advised the Board to reject interchanges presently providing service across the southern U.S.

Greenbaum recommended these new routes:

- Delta Air Lines route beyond its present Ft. Worth terminal to Los Angeles and San Francisco
- National Airlines route beyond its Houston terminal to Los Angeles and San Francisco via San Antonio and El Paso
- Continental Airlines route between Houston and Los Angeles via San Antonio and El Paso
- Republic Airlines route from its Ft. Worth terminal to Miami via New Orleans and Tampa
- Eastern Air Lines route between Atlanta and Dallas/Ft. Worth via Jackson, Miss., and Shreveport, La.

Of the Big Four trunklines, only Eastern would benefit from these recommendations. American Airlines' intercity routes between Texas and California would be bolstered with competition from three of the smaller trunklines.

Amfuso Urges Space Teamwork

Rep. Victor Amfuso (D-N.Y.), chairman of the International Cooperative Subcommittee of the House Space Committee, testified to the committee for a joint U.S.-Soviet effort in space last week with identical letters to President Eisenhower and Russian Premier Nikita Khrushchev. Amfuso told the two leaders:

"...it is not too difficult to visualize the early exchange of scientists as well as operating in the exploration of outer space, as well as an exchange of research information in this field. Scientists, the two nations can jointly undertake specific research projects of common kinds, such as the launching of satellites to sample certain physical phenomena of the universe; the collection of past tracking stations in deep flight articles under continued observation; joint operations in regarding control of space capsules returning to earth and their safe re-entry into the earth's atmosphere. Later, when man is introduced into the space environment, these could be past joint support for control and recovery operations."

In a letter to T. Keith Glennan, administrator of National Aeronautics and Space Administration, Amfuso said he would support NASA's request for a larger budget next year and asked that some of the money be used to expand NASA's international cooperation efforts because "money alone in an all-out race into space will not solve the problem. In such a race, without international cooperation, we could impoverish our nation, without obtaining the peace and the strength we desire."

Soviet Discoverer Photo

Soviet Union, in turn, is publishing first its cooperation with the U.S. in space has revealed into the western eyes. A photograph of Discoverer V, a military satellite, taken by Vladimir Logoskov of the Vologda Pedagogical Institute, was forwarded to the U.S. The Soviet press reported that Dr. Paul Wapale, director of the Smithsonian Astrophysical Observatory, Cambridge, Mass., has sent a reply "to which he warmly thanks" the Soviets for the observation.

Local Airlines Advertising Trades

Local service airlines hopes to expand the scope of applications permitting them to trade transportation for advertising now sought curbed by the Civil Aeronautics Board last week. While granting a one year extension of the basic agreement, which also covers certified intrastate and inter-Alaska carriers and four operators, the Board emphasized that the purpose of the regulation is to provide the airlines a limited amount of relief from the full economic impact of advertising because of their "relatively limited base" and dependence on schools. For that reason CAB rejected the carriers' request to raise the ceiling of the trade value from the present \$100,000 to \$1 million, estimate that past annual values averaged about \$68,000, and that the regulations have never intended to cover the full cost of the airlines' advertising programs.

Northwest Attacks PAA

Northwest Airlines opened its case in the Tennessee state hearings last week with a bitter attack on Pan American World Airways, charging that the carrier "dominates the U.S. flag international air travel industry as an other major U.S. industry is dominated." In his testimony, before Civil Aeronautics Board Examiner William F. Madden, Northwest Vice President C. L. Stewart said that 50% or more of the industry's business is done by Pan American, and he added: "Moreover, if its ownership is more than a dozen other important nationwide airlines... and is able to mobilize the resources of a worldwide network against its smaller competitors in local competitive situations." Stewart's testimony highlighted Northwest's overall preeminence, which was reflected across the attack against Pan American for holding "a monopolistic share of the market in long-haul flights." Donald W. Nease described it. In essence, Northwest has set out to prove that Pan American "seeks to expand its route authorizations to duplicate Northwest's only routes to the Orient, while keeping its major national routes and obtaining for itself an even greater share of the Pacific traffic."

—Washington staff

Belgians, Dutch Weigh Fighter Selection

Re David A. Anderson.

General—Final selection of an all-purpose airplane to replace the Belgian and Dutch air forces is expected in January. Aviation Week has learned. The choice is believed to be between the Lockheed F104 Starfighter and the Dassault Mirage 3.

The prospective order is for approximately 400 complete aircraft plus support equipment and spare. Drex is licentiate owner of 170 Belgian and 200 Dutch. The new airplane is to be capable of three major missions: attack, reconnaissance and interception. It will replace all Republic F-84F fighter bombers, North American F-86K all weather fighters and Fieseler Hunter day fighters now in service for both of the forces.

Official spokesmen for both services emphasize no final choice or decision has been yet made and no intergovernmental agreement exists. Such agreement must provide mutual selection equipment, they added.

Both countries made engineering and pilot evaluations of available foreign aircraft. The Dutch officially named the Starfighter and Mirage 3 in early December. The Belgians are reported for using the Mirage 3 but have made no official comment.

Unofficially, both countries are annoyed at premature reports identifying one as a plane or another as a driver or selected. They feel each driver can improve by the manufacturer involved. Like most European countries, Belgium and Holland want another member.

external pressure. Confucian American sales techniques, including press conferences, are regarded with some suspicion.

The final choice is bound to be made for a combination of military, political and social factors with major emphasis on financing the purchase. Both countries assume Americans will help with cash payment terms if an American plane is bought, but both are uncertain how far the Americans are prepared to go. The French are reported to be offering new terms for the Mirage.

The Belgians are having major budgetary problems, fearing defense cuts and the other defense establishment is now undergoing careful scrutiny for reduction of expenses. Purchase of new equipment is a major share of future budgets and the Belgians probably are placing financial considerations highest on the list of factors.

Small Industries

Another major factor is that both countries have small but vociferous export industries (employing considerable numbers) and for political and social reasons they want to keep these industries alive. The chosen discipline probably be built partially by both countries and terms for doing this could affect final choice.

In case of the Starfighters, negotiations are being conducted on a government-to-government basis and the price is not available. However, recent German orders for the F 104G indicate the unit price of a complete airplane, covered and with crew, approximately

West Germany holds license rights for Western Europe on the F 104C version, which would be practically identical with the Belgian-Dutch *Storfiner*, but the Dutch want to order the plane, total European production would approximate 1,900 units and units could be ordered reasonably. The Belgians and Dutch are free to negotiate either with the Germans or with Lockheed directly because the Germans have raised license rights for the G series in this instance.

Recent talks between the Dutch Defense Minister, S. H. Vinger, and West German Defense Minister Franz Strauss presumably aimed at reaching some pending concessions on the purchase of Starfighters from Germany, have not shown progress, say Dutch sources, and the most recent offer from the French has taken on new significance.

The French are reportedly offering the Mirage T at a price about \$200,000 cheaper than the F-104, with easy terms for payment and license rights for manufacture of most of the daughter Mirage variants: Mirage, Mirage, Mirage and Mirage. Under this proposal, Fokker in Holland would build up to 85% of the Mirage; Belgium would build the Suvarna A100 engine, and Philips in Holland would handle production of avionics equipment.

Reports are that the French are trying to strengthen their aircraft industry and are willing to negotiate as far as it is possible to do so. This market is one of the few left for sale at any price.

British Mercedes

London—The Blackland Aircraft Co. shareholders will be asked to approve the company's acquisition by the Blackley Holdings Group. A takeover bid submitted by Blackley Holdings follows demands by Minister of Aviation Duncan Sandys that the industry regroup into two major subsector companies and two engine companies (AW Dec. 7, p. 35). Earlier discussions between Blackley and Blackland apparently have been discussed (see p. 35).

To effect the merger Harsco Sidsley is making a cash-and-share offer for the Harsco stock worth approximately 3,998 million at current market prices. One Harsco Sidsley common share (\$2.80) would be offered for each of Harsco common share (\$2.80). Three Harsco Sidsley \$15 \$2.80 preferred shares and \$2.80 in cash will be offered for every four of Harsco \$15 \$2.80 preferred shares.

not including spare or ground equipment
recent build in European production of
750 aircraft

Both countries plan to replace a current fighter-bomber and fighter interceptor squadrons with units based around a single airplane. Simulations in earlier problems and plans prompted consideration of re-equipping concepts.

New ARDC Divisions Formed

Washington—Air Research and Development Command officials announced Ballistic Missile Defense and Wright Air Development Divisions last week as one of the four new divisions to be formed under ARDC's reorganization plan.

In the regeneration pattern (AW Oct 12, p. 13) EMID will assume a role as manager of ballistic missile and space systems, and relations with Air Materiel Command Ballistic Missile Center will merge the space May Com Command. It failed to name a new member of EMID.

Ballerie Music. Dariusz will have operational control of the music system out out at Edwards AFB, Calif., and of the 655th Test Wing at Patrick AFB, Fla. The dariusz also directs activities of the 619th Test Wing at Palo Alto, Calif.

Division Responsibilities

Wright Air Development Division was formed at Wright-Patterson AFB Ohio and will be responsible for developing a variety of weapon systems including aircraft, airborne and ground-based systems associated with aircraft, manned space systems and support systems.

The new division includes elements of the Wright Air Development Center and AFMC headquarters. Director

ate of System Management, both of which are being discontinued. One WADC library not included in the new division is the Acoustical Research Library, at Wright-Patterson, which eventually will be assigned to the ARDC Research Division.

Directorate Setup

WADO is coordinated by Maj. Gus Stricker, T. Wray, former WADOC commander. Division includes a Directorate of Systems Management under Brig. Gen. Joseph R. Hultapple, a Directorate of Systems Engineering under Col. Fred J. Acers and a Directorate of Advanced Systems Technology under Col. Albert L. Wallace. Jr. Vice commander of the division is Col. W. R. Goble; chief assistant is John W. Kohn.

Directorate of Systems Management will manage contractor work on weapons systems and will include the Weapons Systems Project Office which operated under the old VRDC Directorate of Systems Management. Directorate of Systems Engineering will provide the engineering competence to direct contractors' technical efforts and the Directorate of Advanced Systems Technology will plan future weapons and work on the advanced technology leading to these future systems.

Germans Re-Order Lockheed F-104s

West German Defense Ministry has confirmed government approval to purchase another 164 Lockheed F-104G Starfighters in addition to the 276 F-104s for which a contract previously was signed in Bonn (AW Feb. 16, p. 31). Cost of the 164 Starfighters is roughly \$600 million.

At German Defense Ministry's request the F400C has been developed for multi-purpose duty as an interceptor, fighter bomber and reconnaissance plane. Negotiations are continuing and a decision is expected to be reached shortly on whether part or all of the M4 aircraft are to be produced under license in Germany.

Of the 256 F134s purchased last February, 200 are now being produced under license in Germany. Of the 50 bought directly from Lockheed, 38 aircraft are scheduled for delivery beginning in May and lasting until October-November, 1961. The remaining 65 airplanes are scheduled to become operational by the end 1960.

Powerplant is the General Electric J79 turbojet engine. The Starfighters will replace the Republic F84F and North American F-86 type aircraft still in service with the German Luftwaffe.

Simultaneously, the newly crowned government agreed to purchase Martin TM71 Miss missiles costing about \$415 million. Subject to further negotiation and agreement between the U.S. and German defense authorities, the Germans propose to equip several battalions with Nike missiles with attack warheads. The formation

Present strength of the German Luftwaffe is 45,000 officers and men while the Defense Ministry aims at drawing up to between 55,000 and 100,000.



USAF Uses Regulus II As Bomarc Target Drone

Several Chance Vought Republic 11B-100s (a large auxiliary aircraft, developed for Navy use) are now being used by USAF as separate flight trainers for the Korean Bomber intercepter while in flight from the Air Force Ground School, Eglin AFB, FL. These flights along the Route have been attempted thus far. In the first, a serious was recorded. Second launch resulted in the destruction of the second 100 in the Route launch site. Third attempt was aborted after a malfunction in the Republic engine. In the picture above, a Lockheed T-33 is making a flyover at Eglin after an evaluation flight.

French Stand Hampers NATO Posture

By Robert K. Feneff

Paris—Efforts to ease NATO's Atlantic Treaty Organization military posture in Western Europe continues to hinge on an unsettled difference between France and the United States over how the NATO treaty should be operated.

Then on the same conclusion down to military observers here at NATO held its annual ministerial meeting on the eve of the Paris Western summit conference. The problem continues to center on French refusal to accept integration of its European allies under unified NATO command. Behind this French military policy, however, the complex, political implications of French President Charles de Gaulle, to force more significant role for France in world affairs.

Military Posture

Military portions of the NATO annual meeting, which opened by an exchange between French and U.S. officials over recent criticism of the French attitude made by Gen. Nathan Twining, Twining, as a secret Paris talk, before NATO's military committee, a fact France, singled out France as the major offender in NATO's sagging military posture.

Defense Secretary Thomas Gates, speaking at the NATO ministerial

meeting, denied a French request that Twining's leaked remarks be republished. Gates told the meeting that the U.S. endorsed the "military substance" of Twining's criticism.

Despite the Franco-American divide, NATO members agreed to support a continuing military program which provides for a considerable buildup of defense delivery capabilities among NATO forces in Western Europe. This program calls for some 150,000 soldiers and 100,000 aircraft by 1967, instead of the present 100. Included in this buildup program will be Martin Marietta and Pershing tactical missiles, and perhaps also NATO development of the French Blue Water tactical missile (AW Dec. 14, p. 20).

Gates said that NATO needs development of weapons such as the Hawk ground-to-air and Sidewinder air-to-air missiles, which European members are financing and building themselves, points to a new trend in NATO's armament program. Gates also cited NATO development of the French Braguet train engine, also anti-submarine warfare aircraft as a "successful project."

Both Gates and U.S. Secretary of State Christian Herter emphasized that the U.S. expected European NATO members to take an active financial burden in keeping NATO's armament up-to-date. European reaction to this

idea, according to a U.S. source, was "warmly, unreservedly." Most U.S. officials, so far, privately expressed their belief that—made from France—even other NATO nations supported the U.S. delegation down the line.

In the NATO ministerial meeting failed to settle Franco-American differences over NATO, few military, abstract aspects of the Western summit conference to do any better. This is because Gen. de Gaulle is fully opposed to NATO's principle of integration of forces at command levels whenever this means France would lose control over the deployment of its national forces. Thus, in certain NATO areas of responsibility, such as European air defense, France alone of the NATO nations has refused to integrate its air units.

The French attitude has been on constant over the years and actually predates Gen. de Gaulle's arrival in power. But NATO officials insist that Soviet advances in weapons over the years has made the question of European integrated air defense vitally important. NATO's only complete late war success, dated for completion late next year, is based on the principle of integrated NATO air defense.

Feet-Dragging

Actually, French foot-dragging within NATO could stem mostly from political apprehensions rather than from military policy. De Gaulle, like his predecessor, feels that France—unlike Great Britain—hasn't received "Big Power" recognition from Washington.

De Gaulle wants to see Washington London and Paris give together in a tight old group to direct Atlantic affairs, not only in Western Europe but in all areas of the world. Since this French concept was rejected rolls in over NATO capital, the French have acted behind their foot-dragging policy, as constant.

Actually, the French attitude toward NATO becomes more complicated by the fact that many French military officials appear to disagree with Gen. de Gaulle over the question of integration. French Gen. Jean Valéry, one member-included. Allied Forces Central Europe, recently declared that "French military policy of non-integration excludes the Central Europe Command." Yet another French general Raymond Besson who holds military status, also is quoted under Valéry, maintained with a statement that no foreign officer which would include the Supreme Allied Commander, U.S. Gen. Lucian Newton, had the right to give his orders to deploy his forces and open his air on an enemy.



Lockheed NC-130B Hercules, fitted with two boundary layer control engines, is tested for its first flight at Lockheed Aircraft's Marietta, Ga. facility. Plane is powered by four Allison T40 turbo-prop engines and has short field takeoff and landing capabilities.

C-130B Modified for Boundary Layer Control

Advanced version of the Lockheed C-130B, the NC-130B has been fitted to be tested for two large compressor engines which will provide boundary layer control for short takeoff and land characteristics. Engines are two T56-A-6s which pump a slush jet of compressed air over control surfaces, channel doors are open for landings and takeoff to 50 deg down position. Accelerated engines close the airplane with its air intake in 400 ft. and will land at a similar distance. NC-130B's four Allison T40 turbo-prop engines fitted with Hamilton Stand and propeller, produce 4450 hp each. Cargo weight is 115,000 lb. to be loaded. Bay angle will be marked down takeoff and land capabilities for the two-engine carrier.



C-130B Bay can be lowered to 50 deg down angle for short field landings, takeoffs.

USAF Sets Three New Records

Edwards AFB, Calif.—An F-104 has established three new world records here by flying the F-104C in 101,395 ft., the F-106 at 1,515.9 mph and the F-106B over a 300 mi. closed course at 1,215.4 mph.

USAF officials announced that the F-104C in the 101,395 ft. record by the Navy last week earlier with a McDonnell F4B (AW Dec. 14, p. 12). Navy last broken a 74,810 ft. record set by the Soviet Union last July.

World speed record set by the Convair F-106 exceeded the 1,644 mph. record claimed in October by the Soviet Union for the single turbojet Sukhoi delta designated the B66. The Russian F-106 should have record topped the official mark at 1,508 mph, and last June by a French Dassault Mirage 15.

Lockheed F-104C was flown by Capt. Joe R. Jordan. During the altitude run the fighter also set a new 10,000 meter (32,808 ft.) record by reaching that level (30,454 ft.) 15 sec. 4.92 sec. from the time the flight began.

May Joseph W. Rogers flew the F-106, a preproduction model instrumental and equipped at record combat weight. His record was at 40,000 ft., the fighter flew the F-106 for 10 sec. 1,215.4 mph.

Flown by F-106B from the 154th Tactical Fighter Squadron at Seymour Johnson AFB, N.C. Maj. Gene Joseph III. More recent the circular 300 mi. record at 113 sec. Flight was made at 50,000 ft., and the pilot was under 2 g during the run. Course was laid out as a circle with a 340 mi. diameter. F-106B was an operational version and weighed 40,454 lb. at takeoff, including 2,000 gal. of fuel.

Records were submitted by National Aeronautics, Army, and Navy, and other supporting data have been submitted to the Fédération Aéronautique Internationale for confirmation of the records.

Pilot of the three aircraft were awarded trophies for their record efforts. Thompson Trophy went to Maj. Joseph for the speed record, speed Bessie award went to Col. Mousa for the closed-course record and the General Electric Trophy was awarded to Capt. Jordan for the record altitude flight.



Side view shows four compressor engines with channel doors open for takeoff, engine provides boundary layer control for takeoff, direction and altitude. Testbed is an advanced version of the C-130B and will make its first flight this month.



BEIJING AIRPORT, completed last March, can handle both jetliners and turboprop aircraft. The Tu-154 jet transport is foreground, with two B-14s and an L-17 near the terminal building. On hard stand in background are An-2s, B-14s, B-16s.

Soviets Push Il-18 in Foreign Markets

Washington—Soviet Union, satisfied that the Il-18 turboprop—the Moscow—Minsk—route of Aeroflot's operational standard, is now pushing the aircraft in foreign markets and pressing its own scheduled service on international routes.

Aeroflot, Russia's state-owned airline, is now operating more than 70 Il-18s, and the aircraft is serving four major routes within the Soviet Union on ad hoc schedules. After placing its adopted practice of leasing a new aircraft through down-front operational subsidies—program before placing them in scheduled service (IAW July 6, p. 30), Aeroflot is now operating the Il-18 on north and south flights that speedily display the airplane's performance capabilities to the Western world.

Latest entry into Western Europe was made with a special flight to Mexico City last month with refueling stops at Khabarovsk and Hakha. The flight was operated to carry A. I. Mikoyan, first deputy chairman of the USSR, General of Aviation, on a "goodwill" mission to Mexico.

The Russians, however, took full ad-

vantage of the flight, placed the aircraft on public display at the Mexico City airport and conducted special demonstration flights for top Mexican aviation officials. Military attaches from Argentina, Brazil, Uruguay and other Latin American countries also were in attendance to inspect the B-18.

During the visit of Soviet Premier Nikita Khrushchev to Washington in September (IAW Sept. 28, p. 45), the Il-18, Tu-114 turboprop and the Tu-304 turboprop, all of which carried the Khrushchev, parts best were not exposed to the general public although approximately 500 aviation and government officials were allowed to inspect the three airplanes during a one-hour period one Sunday.

On the Mexican trip, original plans called for Mikoyan and his party to fly the Moscow-Mexico City route non-stop in an international version of the Tu-114 turboprop transport. But because the Mexican Civil Airport was unable to receive a plane of this great weight, according to the Soviets, the smaller Il-18 was used.

Aeroflot's Deputy Chief for Oper-

ation V. T. Barabkov, who was in charge of the Mexican flight, discussed the possibility of establishing scheduled air service between Russia and Mexico with members of the Mexican Ministry of Communications.

Rather than visit, he remains sent the aircraft to Iraq as a prestige and promotional device in the Middle East. The plane does, the Moscow Regulated route company in five and one-half hours over an indirect routing which could meet from 2,000 mi.

First scheduled operation of the Il-18 as an air route outside the Soviet Union on the London-Moscow route, when it has replaced the Tu-104 turbojet-powered transport. Both European Airlines will receive the Russian aircraft from turboprop to turboprop or, more by replacing its Yakovlev Yermak with Comet 4Bs on the London-Moscow route (p. 1).

In the Far East, the Chinese Air Service began regular scheduled operations with the Il-18 on the Peking-Canton route on Dec. 1. In one trial flight conducted by the Chinese Air Service on the Peking-Wulumu Canton

Shanghai-Peking route, the Il-18 flew the 2,700 mi. in an end-to-end hour in an average speed of 430 mph.

The Chinese now plan to use the Il-18 as the backbone of civil aviation on both domestic and international routes. In announcing the success of the trial flight with the B-18, the Chinese had no opportunity to praise the Soviet planes and L-18, U.S. built aircraft. Here is what one Chinese civil aviation official had to say of the subject.

The success of the trial flight shows China's rapid development in aviation techniques. Since the growth of China's aircraft industry, old-fashioned U.S.-made planes have been needed not as much as in the past. In the country, old Soviet Il-14 passenger planes and Chinese-made airplanes have come into general use. Before the trial flight of the Il-18 passenger plane, China's civil aviation equipment and its aviation system were strengthened and its technical equipment added.

Air Route Growth

According to the Chinese, the aircraft's air routes have tripled to 32,350 mi. in the past 10 years, and the volume of freight transport has increased to a point almost 19 times that of 1950. From the operating statistics available, it is evident that the civil aviation is handling more cargo than passengers in the last few years.

Peking, however, recently announced that "with the solution of lines by an average of 40%, the number of workers, peasants and herders, needing to be sent to increasing day by day."

The Chinese also are reportedly building the Soviet designed An-2. Meanwhile, the Russians are building up international operations before the Il-18 in hopes of securing worldwide prestige for the airplane. Latest promotional effort now in progress is one that a production model B-18 transport carried a 44,000 lb. payload to an altitude of 36,720 ft. The Russians used the data for the flight with the Peking Airlines International Airlines to use for certification as a world record.

In design and performance, the Il-18 is similar to the Lockheed Electra turboprop.

The Soviet plane is powered by four Kuznetsov AI-20 turboprop engines at 4,930 hp each.

It is designed for medium weight and is designed to require less maintenance with reduced pilot workload, permitting more operational operations on part-time flying missions.

The plane operated by Aeroflot has a 50 passenger configuration and flies at a normal cruise speed of 404 mph at 38,000 ft.

Low Ton Mile Costs Reported For Convair 540 by Allegheny

Washington—Allegheny Airlines' third quarter operating statistics on its leased Convair 540 percent with No. 100-1000 turboprop engines indicate the turbine-powered aircraft has produced an available ton mile cost of 12.59 cents compared with a total, so-called airline average of 31.14 cents for all types of aircraft.

Civil Aeronautics Board figures, as shown according to aircraft types, gave a consequently low 12.59 average, based on the available ton mile cost of 30.00 cents. DC-3 average costs of 24.96 cents and costs for Martin and Convair piston aircraft at an average of 19.54 cents. These direct operating costs include fuel, depreciation and direct maintenance, but exclude landing charges and airport payments.

Convair turboprop with 44 seats cost 1,646 cents per available seat mile, according to the CAB figures. F-27 aircraft, by comparison, West Coast Airlines and Pacific Airlines with an average 36 seat capacity, produced a unit mile cost of 2.01 cents, while the DC-1 increased 2.07 cents and the other aircraft types averaged 3.01 cents.

Allegheny's plans to operate the 540 with a 12 seat configuration would drop the cost per available seat mile on the Convair turboprop to an estimated 1.902 cents. The figure, recently announced, is based on the 11 Convair, four of which are converted DC-1s. Convair also is being converted to turboprops by the company.

Purchase also will include the leased aircraft which the company has been operating since July (IAW Nov. 30 p. 40). In terms of available ton mile per hour, the aircraft has a 132 mph and a 1,310 ton miles as a daily, utilization of a little more than six hours. In comparison, the F-27 at an average speed according to the time current of 199.5 mph and utilization rate of 5.5 hr. 54 seats, handled 799 ton miles. Piston-engine Martin and Convair, with average speeds of 182.5 mph and a utilization of 5.1 hr. 35 miles, produced an average of 751 ton miles.

Direct operating expenses, annual depreciation or rental fees on a recent price rule have amounted to 72.41 cents for the 540 turboprop and 74.64 cents for the F-27. However, Allegheny's direct maintenance costs are 22.45 cents for the 540 and 22.45 cents for the F-27.

The lease agreement with Allegheny and would change some ownership of the aircraft is assumed. Breakdown of living expenses, as a result per average plane mile basis, based on cost of 12.59 cents for the 540, lower than the 16.58 cents needed by the piston-

engine Convair and Martin but higher than the 17.37 average costs of 43.87 cents. Most of the unit gap came from higher fuel, of two and a more cost, as shown by Allegheny, for the aircraft.

Convair's DC-3 costs amounted to 37.45 cents.

During the third quarter the 540, which has a ton load capacity of 5.75 tons as compared with the average of 3.15 tons for the F-27, consumed 941 gal. of fuel per hour of flight with a mileage rate per gallon of 0.64. F-27 flights used an average of 214 gal. with a mileage rate of 0.5.

In terms of dollar per acre, plane hour, 540 direct operating expenses, annual depreciation or rental fees, 5505.81 based on hourly flying costs of \$116.78 and direct maintenance expense of \$57.17. F-27 costs in this category came to \$5,651.91 per engine hour. The 540's direct operating expenses average and \$51.91 per direct maintenance.

CAB Examiner Raps Duplicate Cost Reports

Washington—National Airlines and Pan American Grace Airlines have been strongly criticized by a Civil Aeronautics Board examiner for duplicating flight equipment costs in two aircraft used in the New York-Los Angeles market.

Based for Examiner Edward D. Stedole's remarks and recommendations in the Civil Aeronautics Board's decision, investigation in the case, by National of a Douglas DC-6 and a DC-7 from Pan American, 1975 under "complicated" terms which Stedole said is difficult to determine whether the agreement constitutes a straight lease or an installment purchase by National, with depreciation costs deducted from the eventual purchase price. Both airlines have been been clearing the two month long, with depreciation is according reports to the Board, Stedole said, with Pan Am having its claim on legal ownership and National on a purchase lease in the ownership agreement.

The examiner said that duplicate reporting of the same cost, by the two carriers is illegal and tends to affect the accuracy of leased aircraft which are often affected by other government agencies and given national-level distribution.

Stedole told Board members that the agreement essentially constitutes a

AIRLINE OBSERVER

► Heavy import jet transports will have an active business in 1982 by attracting new traffic and skyrocketing the number of available seat miles because evident for the first time during the month of November. During the month—when U.S. carriers were operating 155 turbojets and 55 turbo-prop-engine passenger miles rose to 2.19 billion—a record 25% increase over last November's volume. At the same time, available seat miles showed the sharpest monthly gain in the history of air transportation with a 35% increase over the available seat miles reported in the same month of last year. The real gains—note that all carriers are now going for—lies in the resultant effect on load factors. November's load factor plummeted 4.22 points from last November's figure to 57%—the lowest figure reported by the airlines since Nov. 1958. November also was the second month in the past 14 months that the industry has failed to show a monthly load factor increase.

► Domestic airline common stocks based on the New York Stock Exchange held close to the year's low last week in a market that was moderately heavy. With the possible exception of United and Western Airways, airline stocks were generally modest by most investors who appeared to continue buying activities in regulated securities.

► Air Transport Association board of directors last week approved a 1982 budget of \$2 billion, "slightly" lower than 1981's budget. Total of \$155,000 was authorized to cover the cost of an advertising program promoting the use of an airport port.

► Industries are strong that the merger of Pan American World Airways' Atlantic and Pacific Alaska divisions (AW Dec. 14, p. 38) will be followed by the divestiture of the Latin American Division once the reports of the carrier's pension-fund debt is settled. At this time, all assets involved will be handled at the Miami base, all airlines involved at Miami.

► Charter or purchase of a new piston-engine aircraft is being considered by the Federal automobile manufacturers, Renault, for shipment of parts into the U.S. The car maker now ships parts by commercial airline and believes the end-game market may provide a bargain that would make it more economical to operate its own units.

► French officials insist that the joint Franco-German development of an eight-ton cargo aircraft, the Transal (AW Jan. 13, p. 64), is continuing despite earlier reports from Bonn that German interest in the project is lagging. Reported, the twin-turboprop Transal—Transport Aérospatial being built in three prototypes. The first is scheduled to be built in France by Nord Aviation, the second and third in Germany by West, Henschel and Stahl. Plus also call for Italian participation in the program if it reaches full-scale production.

► Railway Labor Executive Association will support Flight Engineers International Association move to decimate a petition by the Air Line Pilots Association to broaden its craft to include flight engineers for purposes of collective bargaining. A special board named by the National Mediation Board is now hearing the case which directly involves United Air Lines. The railroad union is intervening because of the effect the Board determination sought by the pilots' union might have on craft rights in the railroad industry.

► Seattle reports its twin-turboprop T-144 carried about 5,000 passengers on the Moscow-Glasgow run during the first year of direct air service between the two capitals.

► Pilots have submitted to Capital Airlines a copy of a candidate resolution adopted by the Master Executive Council of the pilot group staffing that office. As of November 24, no Washington airport was not equipped with all-weather radar will be flown whenever weather forecasts indicate air turbulence. However, the airline is now installing radar equipment on its fleet and anticipates the program will be completed well before the pilots' target date.

lose arrangements since Panagra still retains title to the aircraft and that National is not building any substantial equity in the equipment because of low rental payments inherent in National's costs, including depreciation based upon available seat miles of operation. Finding that the aircraft should properly be reported as Panagra assets, the examiner also recommended that they be depreciated in CAA reports in the amount of depreciation included in the National payments as opposed to Panagra's request for a nonrecourse depreciation rate with a 15% residual value.

Compliance with the recommended depreciation rate would exert any capital loss on retirement of the equipment by Panagra. Should not, since the value of the aircraft as the carrier's books should never exceed the balance of the purchase price owed by National.

SHORTLINES

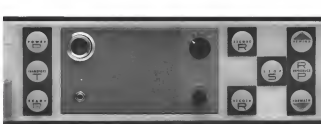
► British European Airways has arranged an all-inclusive package tour with Interwest. Seven state-owned tour agency, which covers eight days in Moscow. Round trip London-Moscow air fare has been set at \$332.

► Federal Aviation Agency, in a new ruling, permits certified mechanics holding inspection authorizations to inspect and certify the airworthiness of single-engine fixed-wing aircraft. This new regulation only permitted inspection by a manufacturer, a certified repair station or a certified air center.

► Los Angeles Board of Airport Commissioners has approved the request of Helibco, Inc., of Glendale, Calif., for operation of helicopter taxi service from Los Angeles International Airport to points in the downtown area. Helibco will operate with eight three-passenger Bell 47's.

► Pan American World Airways recently carried 12,015 lbs. of cargo and mail on its Flight 106 from New York to London.

► University of Michigan has announced that it intends to continue operating Willow Run Airport for general aviation purposes even if commercial airline operations are transferred to the newly Detroit Metropolitan Airport. The university and Willow Run would be developed as a center for personal, corporate, business and other types of aircraft. It also will serve as a base for companies which sell, lease, and maintain planes, including specifically Air-Craft and Great Lakes Airservice.



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U. S., Russian Space Efforts Compared

By Homer E. Newell, Jr.

The U.S. has been using sounding rockets for upper air research and rocket advances since the dawn of World War II. WAC Corporal, V-2, Viking, Aerob, Aerob II, Nike-Deacon, Nike Cajon, Nike-Apog, and Redstone were used. Altitudes attained were below 200 mi for the most part.

Mass hundreds of rockets were fired prior to the start of the International Geophysical Year. Another 200 were fired as part of the International Geophysical Year program. Current rate of rocket soundings is somewhat below 100 per year.

Higher altitude rockets are being introduced into the world to extend the atmospheric observations to one to several thousands of miles altitude. Launchings have been made out of White Sands, N. M., Wallops Island, Va., San Nicolas Island, Calif., Cape Canaveral, Fla., Fort Churchill, Canada, Guam and from ships in the North Atlantic, the Mid and South Pacific, and the north of Antarctica.

Program Results

The U.S. program has produced hundreds of research papers and reports giving results on the pressure, temperature, density, wind, and composition of the upper atmosphere. The program has also yielded valuable data on the ionosphere, aurora, and cosmic ray intensities, solar radiation, and atmospheric structure.

Some experiments have been carried out on modifying the upper atmosphere by the release of special chemicals, and on modifying the ionosphere by ionospheric explosions. Some ionospheric experiments have been successful.

The USSR has also been carrying out a rocket sounding program since the late war. Although the precise number of rocket soundings to date is not known, their number is in the hundreds. Launchings have been made from Plesetsk Launch Area, from Mirny in Antarctica, as well as from Vostochny USSR.

The Soviets have perfected a meteorological sounding rocket that is used for most or less routine soundings of the atmosphere to measure air pressure, density, and temperature up to 15 mi. altitude. In addition, their "graphical auto rocket" is capable of carrying ten radio-altitude payloads up to 100 mi. altitudes.

From their sounding rocket program the USSR has obtained a broad collec-

tion of results. The meteorological soundings have a profound detailed data on the structure of the upper atmosphere past above the troposphere, showing its temporal and seasonal variations.

The cosmological rocket program has provided considerable information on the very high atmosphere including the ionosphere. The description of one of the graphical rocket payloads is as similar to the description of Sputnik III and its instruments as it is to had to recognize that the payload carried here has essentially the Sputnik III payload. Whether or not this is the case, the instrumentation provided for a broad range of measurements on the ionosphere, atmospheric structure, on cosmic particles, and the earth's magnetic field.

The USSR rocket program has also included considerable work on biological research. This has been done since 20 years in which dogs, and even rabbits were sent aloft and recovered for study. During the flight the behavior of the animals was teletransmitted to ground.



Dr. Homer E. Newell, Jr., is assistant director for space sciences in the National Aeronautics and Space Administration. This comparison of space science results achieved by the U.S. and USSR appeared in NASA's one of a series of such studies of the space sciences done by Dr. Newell. Prior to joining the space agency shortly after it was created, Dr. Newell was senior superintendent of the Magnetospheric and Atmosphere Division of Naval Research Laboratory and an ocean program coordinator for Project Vanguard. He holds bachelor and master of arts degrees from Harvard University and a doctorate in mathematics from the University of Wisconsin.

The USSR launched the first intercontinental ballistic missile. To date the USSR has successfully launched three earth satellites, and three space probes. Two of the space probes achieved earth escape velocity, the first passed within two or three times distance of the moon. The second Soviet space probe actually hit the moon. The third space probe was launched to go to Jupiter and to the moon to take pictures of the planet and to take pictures of the moon itself. The Soviet satellites, then to loop around the moon returning to the earth. The lunar pictures were successfully obtained.

The U.S. has to date successfully launched 13 earth satellites—mostly for scientific purposes. Vanguard, Project Saver, and four Discoveries and three space probes all called Pioneer. Only one of the space probes achieved earth escape velocity, getting in the moon at about 17,000 mi. distance.

Both the U.S. and Soviet satellites and space probes have produced valuable scientific results. Included are some spectacular discoveries and achievements, none of which are given in the accompanying Table 1. In addition to the more spectacular output these satellites and space probe flights are bringing out a steady flow of information and results that build up gradually to an impressive achievement of mankind's knowledge of the earth and outer universe. Some of these are listed in Table 2.

Problems Under Attack

In attempting to compare the relative stages of advancement of the U.S. and USSR, in space research, one might proceed by trying to list them in, from the individual results from the two programs and to relate these results to the state of the art.

This would turn out to be difficult even if one were sure that all the results obtained by the Soviets were actually at hand, for there would be many observations obtained by the Russians that had not yet been obtained by the U.S. and, conversely, many obtained by the U.S. that had not yet been obtained by the Russians. A more effective and perhaps more significant way of comparing the advance stages of advancement would be to list the general areas of investigation and the general problems being attacked by the two countries.

Taking this approach one can see that the U.S. and the USSR appear to be at about the same stage of advancement in upper air research. The

U.S. results on the atmosphere below 200 mi. appear to be more detailed and complete, but the Soviets have made better altitude measurements by means of their graphical rocket.

The Soviets appear to have done less than the U.S. in solar radiation, but the USSR has done much more than the U.S. in lower atmosphere research, having conducted numerous flight tests in which dogs were carried aloft in rockets and safely recovered. The USSR has carried the technique of giving instruments payloads from the rocket carrier further than has the U.S., which has carried the technique of teletransmitting to a high degree of refinement.

Likewise, the U.S. and the USSR seem to be at about the same stage of advancement in studies of the earth's

resources when satellite techniques are adequate for making the necessary observations. In fact it was by means of this signal the U.S. has the slight edge. The big advantage the Soviets have in attacking these problems lies in their greater payload capacity. On the other hand, the U.S. has launched more more satellites than the Soviet Union.

In the deep space probe work, the USSR has definitely taken the lead. This is clearly attributable to their clear lead in vehicle technology.

Table 3 provides a comparison of the status of advancement of the U.S. and the USSR.

A review of Table 3 shows fairly clearly that the U.S. and USSR are at about the same stage of advancement in studies of the earth's

As groups they undoubtedly have considerable competence and understanding of the significant problems that ought to be tackled. Their meteorological programs are roughly equivalent, although the U.S. may have a slight edge here, as indicated by the fact that the USSR quite often misrepresents U.S. equipment for its own meteorological.

The conclusion follows then that the side that has the more advanced technology in the way of payload capabilities, guidance, etc., will have the finest edge and be victor of the increased flexibility and capabilities provided by the more advanced technology will be greatly advanced. That, one can predict a more lead in vehicle technology will be transformed into a corresponding more lead in the exploration and reorganization of outer space.

Significant Firsts in Sounding Rocket, Satellite, and Space Probe Research—Table 1

UNITED STATES	USSR
1. A number of facts in high altitude rocket research including: First detailed picture of solar ultraviolet spectrum. First picture of complete tropical cloud. First observation of equatorial convectional current clouds. First detection of X-rays in high atmosphere. Discovery of the Van Allen radiation belt.	1. First artificial earth satellite.
2. Discovery of the Van Allen radiation belt consists of at least two zones.	2. First lunar area map.
3. Discovery that the Van Allen radiation belt consists of at least two zones.	3. First lunar impact.
4. Performance of the Apollo experiments.	4. First picture of the left-hand corner side of the moon.
5. The first genuine prediction of air artificial earth satellite (Vanguard II) to obtain accurate information on the size and shape of the earth, providing an improved value for the flattening and showing that the earth is actually slightly prolate.	5. First detection of what may be a comet tail about the north (the Chapeau-Stomart tag).
6. First achievement of an elementary communication satellite, in Scaev.	6. First nuclear recovery of large animal (dog, and rabbit) from high altitude rocket flights.
7. Development and testing use of a meteorological sounding rocket, measurable and reliable.	7. First launching of a large animal (dog) in a satellite of the earth.
8. First launching of a large animal (dog) in a satellite of the earth.	8. First high capacity, miniature, portable automatic, ground-to-air fully successful long-range communication (Lurch 10).

Sounding Rocket, Satellite, Space Probe Results—Table 2

UPPER ATMOSPHERE	USSR
1. Rocket observations have been made of pressure, temperature, density, composition, and winds of the high atmosphere at a wide variety of locations, both day and night, and in the VOSTOK 10000.	1. Rocket observations have been made of pressure, temperature, density, composition and winds of the high atmosphere at a wide variety of locations, both day and night, and in the VOSTOK 10000.
2. Upper air data have been obtained from the testing of both U.S. and USSR satellites.	2. Upper air data have been obtained from the testing of both U.S. and USSR satellites.
3. It has been shown that the ionosphere belt may account for much higher atmosphere transparency obtained at the ground level atmosphere than at the high atmosphere above the middle and equatorial regions.	3. High enough line of low energy electron measured with Sputnik III instruments in the northern region to account for the higher atmosphere transparency there.

(Continued on p. 48)

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Each time a space traveler leaves home (earth) he has to be completely wrapped in a special environment. He needs it to survive under alien conditions such as extreme heat and cold, high vacuum, cosmic radiation and tremendous G forces.

At Douglas, life scientist research over the past ten years has explored more than forty basic factors relating to human survival in space. Douglas engineers are now compiling — at military request — a careful survey of conditions that will be encountered en route to and on other planets. They are also evolving plans for practical space ships, space stations and moon stations in which men will live and work with security thousands of miles from their home planet.

Out of these research activities and those made by companion workers in this field has come new knowledge of great medical importance... even to those of us who are earthbound.



UNITED STATES	USSR
4	4 Direct measurement of upper ion densities made with gaps in Sputnik III, for heights up to 350 km
5	5
5 Fluctuation in satellite drag, heavy permanently open air detectors have been shown from observations on Vanguard I and Sputnik II to be directly correlated with fluctuations in the 10 cm. radiation from the sun and lower solar activity	6 The routine meteorological sounding rocket has been used to give atmosphere structure data at middle/low/upper Arctic and Antarctic locations showing seasonal variations as well as geographic. It turns out that the seasonal variations are different for the different altitude ranges
6	7
7 From both satellite and rocket observations high altitude ion densities have been shown to vary widely with time of day, season, and geographic position	5 Diffusion irregularities in the upper atmosphere below the E region has been measured with results that agree in general with the U S observations
8 The amounts of diffuse ionization both below and above the E region of the ionosphere have been measured in sounding rocket experiments, and shown to be very slight below the E region and quite pronounced above altitudes of 150 to 450 km	
1	IONOSPHERE
2 Extensive electron density data have been obtained for a number of locations from rocket soundings	1 From rocket soundings electron densities have been obtained up to and above the F region maximum
3 From radio signals of both U S and USSR satellites, propagation characteristics of the atmosphere and electron density distributions have been obtained	2 Electron densities above 300 km were obtained by observation of the radio signals of Sputniks I and III
3	3 Observations on Sputnik I showed 3.5 times as many electrons above the F region maximum as below
4 The heavy ion in the atmosphere above White Sands and Fort Churchill have been identified up to the F region in rocket sounding experiments	4 The ion composition of the ionosphere has been measured in sounding rockets to above the F region maximum
5	5 Sputnik III observations showed that the predominant ion flux 250 to 950 km, is positive atomic oxygen
6	6 In Sputnik III the satellite potential as the densest ionosphere was observed to be as much as several volts
7 Very low frequency propagation data were obtained from Explorer VI	7
8	8 In the second launch evidence of a lower ionosphere was obtained
	MAGNETIC FIELD
1 Data on earth's magnetic field were obtained from Pioneer I and Explorer VI, and a great deal of additional high quality data are being obtained from Vanguard II	1 Data on earth's magnetic field obtained from Sputnik III
2 By their magnetic effect, electric cosmic rays were plotted in the E and lower F regions in rocket sounding experiments as the expected regions	2
5	3 On Moscow, measurements were made of earth's magnetic field and its variations with space. A similar day in the field was documented in the region of the radiation belt, each being perhaps the existence of a constant ring with a positive field in Chapman
4 Rocket measurements of the earth's magnetic field have been made in the auroral region	4
5	5 Launch III, on its plunge to the surface of ocean, showed that the local magnetic field is not greater than 50 gamma
	COSMIC RAYS
1 Extensive data on cosmic ray intensities, composition, and interaction with matter were obtained from sounding rockets at various locations and throughout all the seasons	1 Cosmic radiation measurements have been made in USSR sounding rockets
2 The cosmic ray count was obtained above the atmosphere with counters in Explorer satellites and Pioneer probe	2 The cosmic radiation was measured in Soviet satellites and space probes

(Continued on p. 47)



How Lockheed Aircraft Service cuts man-hours 20% —does "impossible" jobs with ANSCO MONOPAK

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Anasco

X-ray

USSR

- 1 Cosmic ray counts in the first Explorer give discovery of the radiation belt
- 2 Details in the cosmic radiation as a function of time and position in space have been obtained from Explorer VI, and are being obtained from Explorer VII

- 3 Sputnik II observations showed an increase in cosmic ray count height (this being at the time in unaccompanied orbit of the presence of the radiation belt)

- 4 Sputnik III and cosmic rockets provided measurements on the heavy nuclei in the cosmic radiation

RADIATION BELT

- 1 Radiation belt discovered with instruments on Explorer I
- 2 A great amount of additional detail obtained on belt as Explorer III and IV, and the Pioneer probes. Extent of radiation belt shown by Pioneer I. Pioneer III showed belt to consist of at least two areas.
- 3 Pioneer IV showed the extent of the outer radiation belt to have increased greatly following a five-day period of high solar activity, thus proving that the outer belt is of solar origin.
- 4 Apollo experiments showed individual lunar zones of the radiation belt to be very stable
- 5 Apollo observations lend support to conclusion that inner radiation belt produced by cosmic rays. See No. 7 below.
- 6 Detailed energy spectrum of radiation in radiation belt was obtained by Explorer VI
- 7 Scattering rocket observation showed that the energetic particles of the inner radiation belt are protons of energy spectrum expected from beta decay of neutrons, hence supports cosmic ray origin for lead components of inner belt.
- 8 Extensive additional observation on the radiation belt was obtained from Explorer VI and is being obtained from Explorer VII and Vanguard III. Huge variation of magnetic activity as scattering ratio were observed in outer zone.
- 9 Radiological board of radiation belt estimated to be not serious for a direct traverse of the belt, but quite serious for a space station that spends a lot of time in the belt.
- 10

- 1 Abnormally high cosmic ray counts were observed in Sputnik II, particularly at the high latitudes. Sputnik III showed a very high electron flux in the southern latitude

- 2 Sputnik III, Molniya, and other Soviet satellite and space probe observations confirm the U. S. findings

3.

4.

5.

6.

7.

8.

- 9 Radiological board of radiation belt estimated to be not serious for a direct traverse of the belt, but quite serious for a space station that spends a lot of time in the belt.

- 10 The moon was shown not to have a radiation belt detectable within the sensitivity of Lunar instruments.

AURORA

- 1 Rocket soundings have been used to study the electromagnetic and particle radiation in the aurora. It was found that soft radiation flux above 40 km. was many times the primary cosmic ray count.
- 2
- 3 The particles in the outer radiation belt have been shown to be the likely immediate cause of the aurora.

1.

- 2 A very high flux of low energy electrons was observed in Sputniks II and III. This flux was shown to be the cause of the very high atmospheric temperature in these regions.

- 3 The particles in the outer radiation belt have been shown to be the likely immediate cause of the aurora.

GEODESY

- 1 Vanguard I observations give an observation of the earth of 1/29th S.
- 2 Vanguard I observations show the earth to be pear-shaped with a 59 ft peak at the north pole, and a 50 ft flattening at the south pole, this appears to imply an internal strength to the earth, rather than a slow flowing plasticity.

1.

2.

METEOROS

- 1 A fairly low count of meteorites corresponding to a total influx of 1,000 to 10,000 tons of material per day, from Explorers and Pioneer observations.
- 2 A very large amount of additional data are being obtained from the Vanguard III instruments.

- 1 Influx of material per day indicated by Sputnik III observations is in general agreement with the U. S. results.

- 2 Additional measurements made in Soviet cosmic rocket flights

(Continued on p. 47)



U.S. AIR FORCE PHOTO

Power Play

Airplane parts are usually made from steel when they have to deliver real power... or when they have to soak up the whump of a 120-ton bomber as it slams onto the runway.

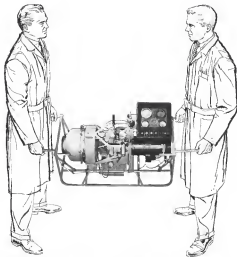
It naturally follows that just any material cannot meet the tough requirements of modern aircraft. It takes the special steels like those developed by United States Steel; for example, USS Stainless "W," a pre-

cipitation hardenable Stainless Steel, as well as other grades of chrome-nickel Stainless Steels for high speed aircraft and missiles, and USS Struc, an alloy steel with a 280,000 minimum psi tensile strength that is ideal for landing gear.

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UNITED STATES

ASTRONOMY

- 1 In sounding rocket experiments ultraviolet sources in the sky have been detected and plotted.
- 2 The solar spectrum has been observed and photographed down to 164 angstroms.
- 3 Solar radiations have been observed and measured in the X-ray region.

LUNAR EXPLORATIONS

1. First photos taken of the left-hand moon side of the moon.
2. The lunar magnetic field shown to be no greater than 50 gauss.
3. Lunar atmosphere detected.

MISCELLANEOUS EXPERIMENTS

1. The Agen experiments were carried out.
2. Sodium vapor was released in the high atmosphere and observed to measure its diffusion atmospheric winds and diffusion.
3. Various chemical constituents were released in the high atmosphere to study the photochemical reactions that resulted.
2. Sodium clouds were released from Launch II and III and observed from the ground.

BIOSCIENCES

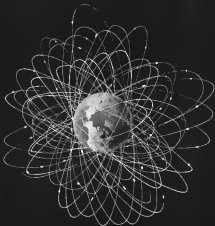
1. On numerous sounding rocket flights biological specimens of seeds, fruit flies, etc., have been flown and recovered for study. Larger animals, such as rats and monkeys, have been flown for study of their behavior and the effects of the flight environment on them. Recovery of such animals has been effected on numerous occasions.
1. Large numbers of sounding rocket experiments have been carried out with dogs and rabbits, in which the animals were both studied during flight and recovered after flight for further study.
2. Observations were made on the behavior of Larks, particularly heron and migration, in Spanish II.

ENGINEERING DATA

1. U. S. satellites show that moderate temperatures can be achieved in orbiting vehicles.
1. USSR satellites and space probes show that moderate temperatures can be achieved by appropriate engineering.
2. Elementary communications link checked out in Project Scout.
3. Based on radiation belt data, it is believed that satellites may change to a potential of some hundreds of volts in the radiation belt.
4. The satellite erosion and pressure problems have been shown to be not particularly serious.
5. An elementary TV camera was checked out in Explorer VI, while some of the data streams of a meteorological probe for were checked out in Vanguard II.
6. Autometer photographs of the moon and the televising of the photographs obtained back to earth has been achieved.
7. Solar cells have been shown to be a practical, reliable source of power.
8. A complete spacecraft, maneuverable, with temperature control, power supply, telemetry communications link, navigational instrumentation, etc., has been engineered and flown successfully, namely, Launch III.
9. It appears that the radiological hazard to space vehicle crews hovering in the radiation belt directly may be relatively low, while the hazard to those in a satellite orbiting through the radiation belt would be quite serious.

(Continued on p. 49)

PHASED ARRAYS



what's where in space. We soon will face the crucial problem of identifying and keeping track of hundreds of man-made objects in outer space. Phased Array Radar techniques, developed at Bendix Radio, offer a solution. If many widely spaced satellites or missiles hurried over the horizon in the same minute, a tremendously high-powered Bendix® radar, directed by a computer, could acquire, identify, track and catalog each one without losing previously acquired targets. The Bendix Radio Phased Array Radar offers the most versatile 3-D data gathering system yet devised. It searches and tracks multiple targets simultaneously. It can provide long-range communications at the same time. If your organization deals in advanced operational concepts and weapons systems, you're invited to contact us to learn more of this latest Bendix space development.

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UNITED STATES

METEOROLOGICAL

USSR

- 1 Numerous sounding rocket photos of cloud formations and significant weather cases have been taken. In particular a composite photo from one sounding rocket showed a completely developed tropical storm approaching hurricane proportions.
- 2
- 3
- 4 Cloud picture data were obtained in Vanguard I, but motion of the satellite here so far prevented inferring the data to earth patterns. Also, very low resolution, electronic television pictures have been taken of cloud formations as seen from Explorer VI. One of these pictures was assembled and released.

- 1 A meteorological sounding rocket was developed and has been used on a routine basis for meteorological studies.
- 3 Detailed analysis of pressure and temperature have been obtained with the meteorological rocket for Antarctic, Arctic, and middle European locations.

4.

Problems Currently Under Attack — Table 3

UNITED STATES

UPPER ATMOSPHERE

USSR

- 1 A detailed study of the structure, winds, and composition of the ionospheric region and beyond in the earth's atmosphere is under way by means of sounding rockets and earth satellites.
- 2 Work is under way to develop a routine rocketborne for spectroscopic studies of the lower portion of the upper atmosphere in association with meteorological soundings.

- 1 A detailed study of the structure, winds, and composition of the ionospheric region and beyond in the earth's atmosphere is under way by means of sounding rockets and earth satellites.

- 2 The USSR has already achieved the development of a routine rocketborne for meteorological type soundings into the lower portion of the upper atmosphere.

IONOSPHERE

Intensive rocket and satellite studies of the ionosphere in the F region and beyond are under way.

Intensive rocket and satellite studies of the ionosphere in the F region and beyond are under way.

MAGNETIC FIELD

The U. S. has used research coils, satellite rare magnetometer and proton precession magnetometer in its measurements of the earth's magnetic field. The U. S. is preparing to use a much more sensitive instrument, the alkali vapor resonant magnetometer, for further studies of magnetic fields in space and to measure the magnetic field of the moon.

The USSR has also used research type magnetometers and proton precession magnetometers for observations of the earth's magnetic field. The USSR has made a commitment to detect the lunar magnetic field, looking upon it as a means to detect the lunar magnetic field, looking upon it as a means to detect the lunar magnetic field. It is not known whether the USSR is preparing to use the alkali vapor magnetometer in the near future.

COSMIC RAYS

Balloons, sounding rockets, and satellite observations of the intensity, nature, and effect of cosmic rays are under way.

Balloons, sounding rockets, and satellite observations of the intensity, nature, and effect of cosmic rays are under way.

RADIATION BELT

Detailed study of the radiation belt by means of sounding rockets, satellites, and space probes, with occasional use of controlled experiments is under way.

The USSR made extensive studies of the radiation belt in Sputnik III but at the present time appears to be investigating the belt considerably as part of their preparation on deeper space missions, namely on their Lench flights.

AURORA

U. S. satellites are helping the problem of both aurora and ionospheric research, the particles associated with the aurora, and the ultimate origin of the aurora.

The USSR accounts are helping the same problem.

GEODESY AND CELESTIAL MECHANICS

U. S. is continuing use of satellites for geodesy studies.

The USSR shows skill in applications of celestial mechanics, as witnessed by their ability to launch Lench III with the accuracy achieved, and to predict the motion of the Lench III spacecraft.

METEORS

The U. S. continues to collect data on meteors in space, using a wide variety of experimental equipment.

The USSR has made an extensive study of meteorites in their satellites and space probes, appearing to check the general picture very much along the lines followed by the U. S.

ASTRONOMY

Active rocket astronomy is being. Debating telescopes, solar, and astronomical observations being studied on.

Unknown

(Continued on p. 50)

The U.S. is preparing to conduct intensive investigations of the moon, but the actual observation of the moon from space vehicles is yet to begin.

PLANETARY INVESTIGATIONS

U.S. has unusual capability in this area of effort, and on the present schedule planetary work is proceeding at a very low pace.

MISCELLANEOUS EXPERIMENTS

U.S. using upper atmosphere regions for controlled chemical and atmospheric experiments. Also planning relatively and gravity experiments.

BIOSCIENCES AND MAN-IN-SPACE

The U.S. has a first stage man-in-space program in Project Mercury. Support work of a man-in-space is being carried out in the Biological Sciences. Some experimental work is being carried out in sounding rocket flights. A well rounded fully developed program of research in both biotechnology and biochemistry is yet to be worked out.

METEOROLOGY

The U.S. is developing radar photographic techniques for meteorological purposes. The U.S. is developing a meteorological satellite for research purposes. The U.S. is conducting many fundamental satellite experiments associated with meteorology, and is taking the initial steps in the development of a meteorological satellite system.

COMMUNICATIONS

In its rocket, satellite and space probe telemetry the U.S. has shown great capability. Long range communication systems being worked on for deep space probes. Communication satellite systems are being worked on.

NAVIGATION

The U.S. is working on a navigation satellite of high degree of refinement.

The USSR has already achieved significant steps in its lunar program and study of the moon. It may be presumed that the Soviets will continue their vigorous efforts in this area.

PLANETARY INVESTIGATIONS

The USSR has an unusual capability in this area, and has declared its definite interest in planetary research.

MISCELLANEOUS EXPERIMENTS

Unknown

The USSR has a highly active program of research on man-in-space under rocket flight and satellite conditions. It is not known how fully developed their biotechnology and biochemistry laboratory program are. It is expected, particularly from recent news releases, that the USSR does have a man-in-space program.

The USSR has already developed a working meteorological satellite which flies high above and is intended to be used in the future in the future of developing a satellite meteorological system.

The USSR rocket, satellite, and space probe telemetry has been successful. In particular the communication and telemetry program of Lunik III appear to have been worked out with a high degree of competence. It is not known whether they are developing a communication satellite system, but it may be presumed that they are.

It is not known whether the USSR is driving effort to a navigation satellite.

Ehrlicke Asks Single Space Chief

New York—Responsibility for the country's space effort needs to be placed in the hands of one man who would have executive authority comparable to that of the President, according to a leading U.S. space official. Speaking at the Wings Club here, General Keith A. Ehrlicke also made definite suggestions as to how the U.S. might regain the lead in space technology that was held by Russia, Ehrlicke suggested.

•Centralization of development effort on a limited number of vehicles in place of the current "shotgun" approach. U.S. space progress has suffered in attempting too many things, he claimed. •Two most promising vehicles under development are the Altex Gemini and the Saturn, according to Ehrlicke. These, he said, will enable the U.S. to establish sustained space stations and carry out lunar reconnaissance. First Gemini was to be fired in 1962.

•The country must decide what to do in the future in space but should not necessarily do any space effort on the basis of Russian achievements.

Ehrlicke believes that Russia will try Altex Gemini in October, 1962 and a Venus shot in January, 1963.

•During the next decade, the primary objective of United States space exploration should be a carefully planned program of lunar research culminating in a lunar landing of a manned vehicle. Over the same period, this country's primary objectives for space utilization should be the launching of communication, meteorological, astronomical and navigation satellites. Also in this

time interval but on a lower priority budget, the U.S. should continue its launching of deep space probes.

•Next step in powerplant work should be the development of large liquid hydrogen-based engine boosters with 200,000 to 250,000-lb thrust which could be used in combinations of two and three to launch a large nuclear rocket engine of 700,000 lb thrust.

Ehrlicke was asked the reasons for the delay in Altex boosters but the Altex-Altex space vehicles. The problem he said, was not in the production end, General can make a more Altex in regard to all U.S. programs. Over the National Aeronautics and Space Administration requirements. He said Altex boosters for an Altex booster, it takes approximately 1 1/2 of a year for delivery. NASA, however, usually wants the boosters in about 100 days, and to bring a regular Altex back into the shop for modification is a costly and time-consuming process that also dampens regular nuclear production.

Moreover, he said, space research is a long-term project now. The military, NASA and the Defense Research Agency get lost all on vehicles and, more critical, on launching facilities.



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1964 First to fly a helicopter powered by twin turbines.
1966 Kaman flew the first helicopter to be powered with a gas turbine designed specifically for helicopters.
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THE YEARS BEHIND PUT KAMAN YEARS AHEAD IN TURBINES

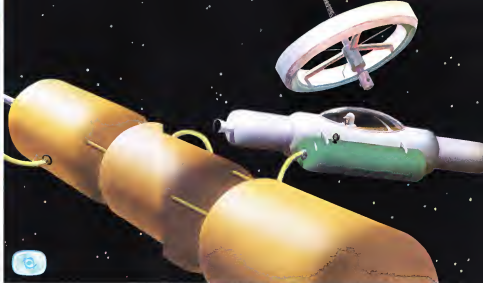


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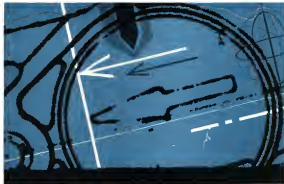
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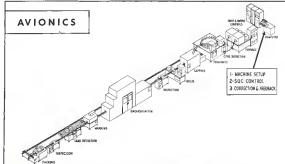
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AVIONICS



NATION's first fully-automated facility for producing deposited carbon resistors, using digital computer to program work, and to perform statistical quality control, will soon go into operation at Western Electric plant near Winston-Salem, N. C.

Computer Controls Resistor Production

By Philip J. Klaus

Winston-Salem, N. C.—The nation's first fully-automated facility for making precision-deposited carbon resistors, with the complete process being continuously monitored and controlled from a central digital computer, will go into operation here shortly at Western Electric.

The fully automated line will make fixtures, sockets, test and peak precision resistors without human operation or intervention at a rate of 1,000 units per hour in 1- to 2-watt sizes, 2,400 per hour in 1/2-watt sizes. This is equivalent to an annual production rate of 1.6 mil lion resistors per year on a two-shift basis. The computer will not only control the production of the final units but will also control the number of each type resistor produced according to programmed needs.

If Defense Department's automatic production testing and offset on the Nike Zeus program, it is expected that those of four companies will share in the production of the final units. Under these circumstances, Western Electric will negotiate with other producers for the use of identical automated facilities to more uniformly and interchangeably of all products' interests. This is similar to the company's policy on the 2N1790 case (resistor) used in the Zeus (AW Nov 32, p. 74).

Cost Reduction

The new facility is expected to cut resistor cost by about one third, but its primary objective is to provide the higher quality, ultra-reliable units needed for the Nike Zeus and for the Red Storm. Western Electric has spent about \$1 million in research funds to date in development of the new facility and in constructing two automated production lines, one to manufacture 1- to 2-watt resistors, the other for 1/2-watt units.

Perhaps the most interesting aspect of the Western Electric program is the

use of a central digital computer to control the number of resistors of each type produced, in accordance with programmed needs, and to perform statistical quality control analysis on a "real-time" basis in the units are being fabricated.

Inspection at critical stages of the process are performed automatically and the results fed back to the computer instantly for analysis so the computer can alter any portion of the process as required to maintain desired product uniformity and/or quality.

Redesign for Automation

When Western Electric started the project over two years ago, its primary objective was to improve product quality and reliability with automation as a means to this end rather than an end in itself, according to I. D. Schell, Schell, who sponsored the team of engineers that developed the new facility, a constant improvement of manufacturing and diagnostic engineering for the company at Western Electric.

The deposited film resistor basically is just a complicated device. It consists of a thin film of pure resistive film carbon, deposited on a short ceramic rod. After deposition, the carbon coated rod has a special path cut along its length like the film on a wire. The path of the spiral cut determines the effective

Some Properties of "K" Monel alloy at Low Temperatures

Condition	Temp. °F	Yield Strength KSI 1000 psi	Tensile Strength KSI 1000 psi	Elong. 0.02 in. in. 2 in.	Reduc- tion in Area %
Cold drawn, annealed	Room	120,800	160,000	30.5	33.8
Cold drawn, 400 hardened	+118	134,600	171,200	17.3	45.5
Cold drawn, 400 hardened	-338	165,200	202,900	27.9	47.4

*Typical values

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For information on low-temperature properties of these standard production alloys, send for "Some Properties of Huntington Alloys at Low Temperatures" Ask about the new high-temperature alloys, too... if that's where your special interest lies.

*Data furnished

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WESTERN ELECTRIC'S advanced filter will produce low rates of unregulated pressure deposited. This reaction ranges from 1- to 2-watt rating.

two carbon path length, heat its own all resistance. The leads are then attached to the rod and it is mounted in a suitable enclosure.

Despite the device's inherent simplicity, there are many potential pitfalls in its manufacture which can result in poor quality and/or short life. If any organic material comes into contact with the fine film during assembly, it can result in a change in the most sensitive value in subsequent use and/or short life, according to Schiller.

Contamination Factor

There are many approaches for such contamination in a non-automated process of manufacture, according to Schiller. For example, carbon film for use in a furnace where moisture gas is heated until it decomposes to produce crystalline carbon. Impurities caused by the deposition process and spalling usually require an operator to even with rub down each unit to achieve the desired resistance. If this step develops in portions of the film as a result of the rubdown, this causes hot spots and short life.

Western Electric engineers concluded that precise control with feedback during deposition of the carbon film and subsequent spalling could eliminate the need for manual touch-down operations and the resultant possibility of contamination. For similar reasons, Western Electric decided to supply as in line production line with the units being transported between



DEPOSITED FILM units was referred to by the manufacturer and to compare quality and reliability due to its Nitro-Zinc anti-oxidation/bacterial bacteria mode.



1. Electric Coated Pump, Model 3021: 1/2 hp. liquid cooling system. Fluid cooled 6 HP. continuous duty motor. Weight, 7.5 lbs. 400 cycles. 115/200 volts. Pump pressure rate: 88 PSI at 53 GPM.

2. Water System Coated Pressure Source: For recirculating water systems. Available with overhead pressure switch. 1/2 hp. continuous duty motor. Weight, 1.8-400 cycles. 115/200 volts. Gas run dry. Pump pressure rate: 25 PSI at 34 GPM.

3. Electric Coated Pump, Model 3021: For liquid cooling system. Fluid cooled 15 HP. continuous duty motor. Carbon bearings. Can run dry. Weight, 21 lbs. 400 cycles. 115/200 volts. Pump pressure rate: 25 PSI at 34 GPM.



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Task's special motor design concepts, combined with advanced pump techniques have resulted in a line of light weight, high efficiency pumps for fuels, lubricants, dielectrics, coolants and potables.

Unique internal construction permits operation of integral fluid-cooled motors without viscous losses normally associated with the motor rotor. Wet motor construction obviates the use of rotating seals and attendant leakage problems.

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Holley Announces A Nationwide Service Network of Commercial Jet Airliners



Service or replacement of Holley's compressor bleed governors, bleed pattern and bleed valve actuators is now instantly available throughout the U.S.

In 14 key areas throughout the U. S., there is now a competent Holley service shop readily accessible to airlines flying the Boeing 707 or Douglas DC-8. These service outlets are fully equipped and stocked branches or main service departments of three well-known aviation parts and service distributors: Pacific Air motive, Southwest Air motive, and Airwork.

Each of these distributors has personnel specially trained in the servicing of Holley aircraft products and each maintains a stock of both assembled units and components of Holley compressor bleed governors and actuators. Replacement or service of these jet engine accessories is literally only minutes away from any metropolitan center.

If you would like a complete brochure of Holley products, facilities, and service outlets, simply address the Aircraft Division at Holley.



Leader in the Design, Development and Manufacture of Jet Engine Fuel Metering Devices



West Coast and other Western states business and commercial customers are served through the selected branches of the Pacific Air motive Corporation and its subsidiaries.



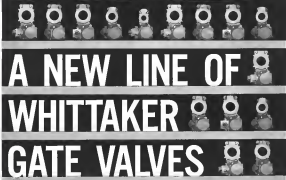
The nationwide new facilities of the Southwest Air motive Corporation at Love Field, Dallas, Texas, are headquarters for Holley sales and service for Dallas and other south Texas areas.



East Coast and Southeastern sales and service are provided through the organization of the Airwork Corporation and its several branch locations.



NOW... OFF THE SHELF!



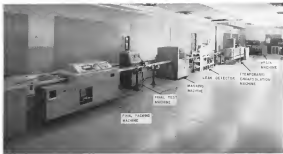
At last... a standard gate valve that can be adapted quickly to any gas or hydraulic application. After years of manufacturing over 3,000,000 gate valves, WHITTAKER CONTROLS now presents a complete line of standard gate valves incorporating the finest time-proven features. Whittaker conceived and developed the much imitated concept of the air-purge mechanically loaded and retained Teflon dynamic seals. This allows satisfactory operation under the most demanding fluid characteristics and environmental conditions. Whatever your requirements in fluid controls, Whittaker can provide the answer. (Note these features, a interchangeable actuator—can be detached without removing valve from plumbing • low torque manual override • rugged construction—corrosion resistant, weathproof, insensitive to temperature change • thorough qualification testing—meets or surpasses all requirements of MIL-8808 • withstands up to 40 g vibration over a wide spectrum of frequencies • instantaneous delivery—are experienced for all applications. Write for brochure or call any of our offices for information.

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915 North Cimarron Avenue, Los Angeles 28, Calif. • (213) 641-8181. Branch offices: New York, Atlanta, Seattle, Wichita, Dayton.



ACTUAL LAYOUT of automated water facility, which will produce devices for Nib, Zee and for Bell System use, differs slightly from sketch in that line is "fixed" at a 90-deg. angle and the leak detector is moved ahead of the automatic washing machine.

cally in tubes or pallets between individual machines on the line.

Company engineers incorporated a number of new design features to improve reliability, performance and to ease the task of operation. For example, instead of rolling on wheels, point at each end of the film, followed by a long heling process, to provide a means of electrical connection the new design employs firm gold films which are quickly spotwelded on to a wet-wash chamber. Gold-plated end-caps to which leads have been attached by precision welding replace the old tin-plated end-caps to improve contact reliability. These changes have reduced contact noise by a factor of 4:1.

First step in the new Western Electric automated line is the deposition of the carbon film on individual ceramic rods, or cones as they are called. The control computer controls furnace temperature, the flow of methane gas and the rate at which the cones pass through the furnace, which determines the thickness of the deposited film and hence the resistance. With computer control, the resistance of the cone can be controlled to within 2% instead of the former 25%, eliminating the need for sorting before the advent of spooling operations.

The cones are then transported to an inspection machine which checks physical size of deposited film and feeds the results to the control computer. If the cones show a significant drift from the desired value, the computer automatically adjusts the spooling parameters of the deposition furnace.

The next step in the process is the



LSP-30 digital computer (below) right controls the other major manufacturing process including wire etching, machine changeovers and statistical quality control. Transistor test machine and deposition furnace are shown above.



Third generation of ARMA computers:
THE SECOND GENERATION

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that can think
anywhere

The systems of tomorrow will require digital computers that can think anywhere—intellects that will remain superior in any environment.

ARMA—already producing metal guidance systems for the ATLAS ICBM—has accepted the challenge and developed a lightweight, second-generation digital computer applicable to all types of navigation. It can be used in space, atmospheric, surface, subterranean and ground naviga-

tion, making possible programming flexibility.

This all-solid state computer, with no moving parts and using silicon semiconductor exclusively, has a memory that is non-volatile and has non-destructive readout. And this computer has substantially fewer parts than ARMA's first-generation production model, which has a test performance unequalled by any other digital computer.

An even more sophisticated third-generation computer, surpassing the reliability of the first two with still less weight, will be produced in the future by ARMA. The reliability of all three generations will be assured by thorough testing in ARMA's environmental facilities—the most complete in the industry.

ARMA, Garden City, N. Y., a division of American Bosch Airma Corp., the future is our business.

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AMERICAN BOSCH ARMA CORPORATION

with exit, and the 1-watt motor case is shorter than that of the 2-watt unit. For those residues which resist change over to accommodate the different two diameter or length at the end of one batch and the beginning of another, a magnetic pellet is inserted in the contact tube between the batches to signal the changeover point.

Average changeover time is about three seconds for all the machines except the deposition furnace. In the furnace a longer time is required because the temperature and gas flow must reach equilibrium conditions. Until this is accomplished, a changeover from one setting to another may cause the loss of as much as 10 cents. However, at this stage in the process the cost is relatively inexpensive, Schiller points out.

Western Electric has designed each machine to be a self-contained operating unit complete with automatic controls to permit it to operate independently in the event the computer becomes inoperative or it is desired to operate without the computer. Under such circumstances, human supervisors would reverse the production programming and quality control functions.

Motorola to Acquire LearCal Division

Santa Monica, Calif.—Lear will sell its LearCal Division, maker of communications, navigation and flight control systems for general aviation aircraft, to Motorola, Inc., in exchange for Motorola stock if approval can be reached on an exchange price. Approximately 20,000 to 30,000 shares of Motorola stock are expected to be involved.

Transfer is expected to take place in January, with LearCal becoming Motorola Avionics Electronics, Inc., a wholly owned subsidiary. Kenneth M. Miller will remain as manager of the operation. Motorola says it will move the new subsidiary to another facility in or near Santa Monica as soon as the transfer proves feasible. Previous negotiations between the companies had fallen through, because Motorola reportedly seemed to want the operation to be a Chicago facility.

The LearCal Division, which employs approximately 400 people, including 50 engineers, accounts for about 85 million sales, or about 3% of Lear's anticipated 1959 total. Balance of Lear's business is in light aircraft, instruments and accessories.

Although the LearCal Division had not been as profitable as Lear's other divisions in recent years, the move seems to be a surprise to many because of the personal interest in general aviation activities by William F. Lear, head chairman and principal stockholder.

Avionics Installations Gaining in Lightplanes

Washington—Avionics equipment installed in general aviation aircraft, particularly single-engine types, is rising faster at more points, has shown a sharp increase over the past four years, according to a Federal Aviation Agency survey just released.

An FAA survey declares that 99% of the nation's single-engine aircraft now equipped with communications (COM) received in Jan. 1, 1958, as compared with 19% in 1954. Approximately 55% of the nation's 64,930 single-engine air-

craft carried two-way radio equipment as compared with 46% in 1954. FAA figures show that 93% of the country's 5,370 multi-engine general aviation aircraft were certified with VOR navigation systems in 1955 as compared with 72% in 1954. Approximately 57% of these aircraft carried two-way radio equipment (transmitter and receiver) in 1958, compared with 31% in 1954.

The survey shows that 33% of the single-engine aircraft have no radio equipment, while 3% have a radio receiver only. In 1954, 39% had no radio equipment while 14% had radio receiver only. In the interval, some of



Taking The Stress Out Of A Master Rod

A properly fitted bulk pin sets up enough internal stress in the master rod bolts to bulge the crank shaft bearing area very slightly. These bulges are so small they are almost impossible to detect. But they sometimes set up enough stress to crack the master rod bore during the engine's operating cycle. Master rods are expensive to replace.

This simple Airwork "stress" sharply reduces the danger of bore cracking. After the bulk pins are in place, Airwork uses an electric hose to eliminate the tiny internal bulges caused by

pin pressure. Then we make sure the bearing area is perfectly circular after the pins are in place.

It takes only a few extra minutes to have a pre-assembled master rod to perfect roundness.

But it adds a lot to the satisfaction you get from a smooth running, long lived Airwork overhead engine. Airwork saves you time and trouble by doing more work at overhaul, when it can be done at fix cost and no inconvenience to you. Give your engine an Airwork overhaul—and be sure of maximum operating satisfaction.

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Versatile Ground Support for Jet Transport Fleets



Extremely reliable and diversified, AiResearch mobile ground support equipment provides multi engine starting for turbine-powered aircraft, and ground air conditioning and electrical power for both aircraft and vehicles.

Heart of the lightweight ground support systems are AiResearch gas turbine compressors which provide pneumatic and/or electric power. Electrical power is supplied when the unit is coupled with an alternator.

GROUND POWER FLYAWAY UNITS for jet engine starting are designed to meet the need for a mobile low cost pneumatic power source which is readily air portable for

emergency use. These lightweight, self-contained units are mounted on a compact cart complete with outrigger, panel and enclosure. They can also be used for aircraft ground support when pneumatic power is required.

GROUND POWER VEHICLES supply both pneumatic and electrical power for jet engine starting, ground air conditioning and other ground requirements where these types of power are needed. Air and electrical connections located at the front of the vehicle allow the operator to drive forward into position. The instrument and control panel are inside the cab, and the power unit is easily accessible through

walk doors on both sides of the vehicle. Full rated alternator delivers output power output level below 90 decibels at a distance of 10 feet.

GROUND POWER TRAILERS provide pneumatic power for jet engine starting on ground air conditioning ... and electrical power when equipped with an alternator. These rugged, compact self-contained units are also fully rated alternators. Servicing is easily accomplished through ample access doors.

AiResearch ground support equipment can be designed to meet specific requirements or installed on standard vehicles. Your inquiries are invited.



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Systems, Packages and Components for: AIRCRAFT, MISSILE, ELECTRONIC, NUCLEAR AND INDUSTRIAL APPLICATIONS

the aircraft with receivers only appear to have added transmitters to achieve two-way capability.

Analysis of the single-engine aircraft engine equipment shows that 87% of those that can carry three passengers or more are equipped with two-way radio equipment, approaching the figure for multi-engine aircraft, while only 32% of the single and two-place aircraft are so equipped.

Similarly, 72% of the three-place or more single-engine aircraft were equipped with VOR, compared with only 36% for single- and two-place aircraft. In 1954, only 44% of the type aircraft were equipped with VOR.

The survey indicates that 70% of the multi-engine aircraft carried instrument approach (ILS) equipment in 1955 as compared with 50% in 1954. In the single-engine aircraft category, 41% carried ILS equipment in 1955, more than double the 2% so equipped in 1954. In the three or more-place single-engine category, 9% of the aircraft are equipped with ILS as compared with 3% in 1954.

In the multi-engine aircraft category, 99% carried automatic direction finding as 74% as compared with 60% in 1954. In the single-engine category, 14% were equipped with ADF in 1955 as compared with 8% in 1954.

The FAA report contains additional details on types of screens and transmitters carried, number of channels available and related data. Copy of the report, entitled "General Aviation Aircraft Radio Equipment, 1955," can be had from Government Printing Office, Washington 25, D.C. at a cost of 20 cents per copy.

TEST FILTER CENTER
333,850

► Raytheon Wave Pattern Analyzer—Capable to select a coefficient to build an advanced Polaris guidance computer and associated model systems using newly developed solid-state construction has been sent by Raytheon the company is using the accuracy in the subminiature construction technique (AW Aug 24, p. 104). Raytheon will build to a basic design developed by Massachusetts Institute of Technology's Instrumentation Laboratory.

► Hot New Semiconductor—Army Signal Corps has constructed a diode out of gallium phosphide that can withstand temperatures of up to 1,000°F. Army Signal Research and Development Laboratory at Ft. Monmouth reports that it is continuing its studies of basic material properties before launching a device development program.

PROTECTION AGAINST IN-FLIGHT FAILURE



Lisle/Magnetic Chip Detectors provide a constant warning system against in-flight failures when connected to a light on the flight engineer's or pilot's instrument panel.

Presence of foreign particles in the lubricant is a proven indicator of internal breakdown. The powerful magnet in the Chip Detector picks up these particles as they appear. The particles bridge or electrically maintain gap in the Chip Detector and complete a circuit which activates the warning light.

As an alternative to a permanently wired system, Chip Detectors can be ground checked with a continuity tester.

Write for complete engineering information and test samples



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■ If we were teenage boys instead of quality minded producers, we would never keep our performance rack so full and on the close-reference hand you after you find quality we intend to be... and "quality" we will continue to strive... this every fact of TMI small diameter tubing we are privileged to provide for the whole range of applications—medical, chemical, pharmaceutical, oil, industrial.

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storage, defense, relayed to the earth's surface, reproduced, and consumed." The status of the Midec system for detection of hostile ships by satellites equipped with infrared sensors "would appear marginal in comparison with the Navy's ground-based Project Ye pos reconnaissance radar system, and other means of detecting missiles early in flight, but an infrared system might prove less prone to spoofing or jamming from radar and threats at the very least, provide some verification of which warnings obtained from other sources." There appears to be little hope of the Midec system, or other satellite-based missile detection, becoming operational in time to achieve our strategic objectives of their increased vulnerability to missile attack."

■ **Non-strategic weapons** "U.S. should increase the strength of its sea-based capabilities... to deter or stop such attacks as the Soviets would dare to launch." The report observed that, as a defense war becomes increasingly hazardous for an aggressor and the threat of striking it increasingly credible, "the employment of localized military force for achievement of national objectives will become increasingly attractive."

Research Administration

In the field of administration of weapons system research development and production, the report maintained that the decreasing military capabilities at the Soviet distribution is not an overall advantage. The difficulty and danger of continuing official decreases in a deteriorating rate lead to less refined and more costly end products as well as to the production of weapons directed to the support of national state.

Commenting that "some radical in nature, also out, is necessary to solve the U.S.'s long lead-time problem, the report said:

"Believing in the acceptance of new ideas and speed in their execution are qualities no other has. The inherent agility that capital is to be characteristic of the Soviet system are allowed to offset the demerits that should characterize the American system."

Yet, the current popular view to improve R&D through more and through elimination of "bureaucratic duplication" and "overhead" when put into practice frequently lead to excessive administrative suppression the blocking of new and useful ideas and the failure of shorting long-range R&D programs toward an overall capability of the end product instead of an alternative, the report suggested that it would be valuable to lower bureaucratic constraints and to increase duplication of effort at all stages of military research and development.



VOUGHT SEES SPACE WITH A MAN IN IT

At Vought Astronautics, space and manned flight into space are coming steadily nearer.

In the Human Factors Laboratory, engineers and scientists operate earth-orbit simulators and space-craft mock-ups as complete in cockpit detail as a production aircraft.

Company pilot-engineers have run up a total of more than 1000 simulated orbital flights. In other studies, Vought space medicine specialists are developing closed ecological systems to provide an oxygen, food and water for flights lasting months, years... generations.

Finally, Vought Astronautics' interest in space centers around the man who will explore it at first hand, and around the man-carrying portions of its vehicles. This has been a natural step for the life-sciences engineers who guided so much experience on Vought's high-performance aircraft.

Through participation in the Dyna-Solar development competition, these men already have applied strength human-factors experience to space. In the course of space-flight and navigation simulations, these men probably are further ahead than any U.S. team.

A major Vought effort now is to determine which functions of space flight will be man-operated and which will be automated to assist. The answers very likely will come out of a simulator—one which duplicates the stresses of space flight.

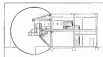
Space is the specialty of Vought Astronautics. Other major interests are being aggressively advanced in the company's Aerospace Division—aircraft attrition, atmospheric sciences, astronautics, aerospace and pilot aircraft—and in the Electronics, Range Systems and Research Division.

VOUGHT
AEROSPACE



A PLACE TO IRON OUT THE STRESSES OF SPACE

Seventeen different stresses will buy the minds and bodies of the first astronauts. Under the combined attack of acceleration, acidity, heat and other ailments, how will man perform? The answer probably won't be known until the problems can be simulated, in all of its parameters Vought Astronautics—a division of Chance Vought Aircraft, Inc.—is preparing the way with the proposed simulators above. Inside the laboratory's mock space vehicle, a man—without leaving the ground—would know the heat, movement, noise—and many psychological effects—of an extra-terrestrial voyage. He would plunger a preflight, yawing close-up of the solar system. He would experience, altogether, an irrefutable preview of combined stresses of space flight. Vought Astronautics can produce and operate such a lab now for the development of spacecraft and the training of pilots.



From prime flight instruments, motion, and a plane from projection—a realistic preview of space flight



VOUGHT
AEROSPACE



HOVER HIGH. Mi-4S taken off during hovering tests. Found a hover in take-out. This latest modified version of the Mi-4 carries one every 16 passengers in an extremely strong load of 3,500 lb. Purchase price is \$200,000, including spares and technical assistance.

Soviets Break Into Western Market With Mi-4S Sale

By David A. Anderson

Klagenfurt, Austria—Roman built Mi-4S helicopters, first to be purchased by any Western country, is being flight checked here before entering service in resort areas this winter.

The helicopter was bought for a syndicate of Austrian and Swiss hotel operators, to carry passengers from mountain resorts in the two countries up to the clinics in the mountains. In off-season months the operators ex-

pect to use it for freight work as well as passenger flights.

The Russian helicopter is the latest modified version of the Mi-4 series and is capable of carrying up to 16 passengers or an extremely strong load of 3,500 lb. Purchase price is \$200,000, including two sets of spare parts and technical assistance.

Operators are interested in the purchase of a second Mi-4S if operational data from the first one is favorable. They are also thinking seriously of buy-

ing the much larger twin turbine Mi-6, and exploration negotiations are scheduled to start soon between their representatives and the Russians.

The Soviet craft is being flown under a temporary 20-hr permit granted by Austria, and an antitanker while they complete their study of documentation furnished with the Mi-4S. Back-logged characteristics are currently lacking, says an Austrian spokesman, but the Russians have promised to send them as soon as possible. Certification



ENGINE OF MI-4S is run up on testbed at Klagenfurt, Austria, airport. Pilot and copilot have good forward visibility. Hovering in clear, straight and with no visible vibrations. Motor system and 14-shafted Mi-4S powerplant are guaranteed for 600 hr between overhauls.

is expected to follow in a matter of weeks.

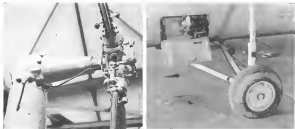
Current flying is under the direction of Rudolf Kogelman, chief factory test pilot for the construction group headed by Mikhail Mui, designer of the Mi-1, Mi-4 and Mi-6 series of helicopters. Kogelman currently holds three world records, two with the Mi-6 and one with the Mi-4 (4,410 lb payload carried to 19,770 ft). Ground operations are under the guidance of two Russian technicians, one an aviator specialist, the other an engine and powerplant mechanic.

Major part of the Russian duties is instruction of Austrian pilots (Baderman and Fuchs), and to check out the ground crew that will take over maintenance and overhaul of the Mi-4S.

In cost, characteristics and performance, the Mi-4 has no direct counterpart in the West. Although it stands in one version as an 11-seat transport comparable in capacity with the Sikorski S-55, it has almost three times the power and weighs a little more than twice as much. But the Russian practice of starting conservatively has been applied to the Mi-4 design also and it now carries officially a 3,100-lb payload, although the world record shows that its capabilities exceed that load limit.

In its present status the Mi-4 is heavier than either the Sikorski S-55 or the Westland Wessex, has about 200 more installed horsepower, a much larger rotor diameter, and a payload officially placed at about two thirds that of

ROTOR BLADES of the Mi-4S are fabric-covered and have rubber flaps on the trailing edges to relieve stress on the blade covering during rotation. Rotor diameter is approximately 60 ft. Blades have built-in shock-absorbing system, no warning indicator is on cockpit



TAIL ROTOR of Mi-4S is three-bladed (left). Main landing gear (right) is shockingly simple. It consists of two drag links and one compression member with hydraulic shock strut. Two pressure air lift boots which are approximately 60 psi

The U.S. Navy POLARIS, developed by Lockheed: From ocean depths to any target



Navy's hidden nuclear submarine (1) launches a solid-propellant Polaris missile, which rises from the depths (2), reaches its way into space (3). Floating overhead minutes later, the warhead of the Polaris re-enters earth's atmosphere (4) and destroys its target (5).

America can breathe easier next year when the Lockheed-developed Polaris missile goes to sea aboard the Navy's nuclear-powered submarines—far ahead of original schedule. For every significant military target will be within its ultimate range of 1500 nautical miles.

To be an effective deterrent to aggression, a weapon system must be safe from surprise, ready to strike back after any attack. The Navy's Polaris submarines will be immune to detection as they grow submerged for weeks at a time. And they'll move the bullseye of enemy attack from our

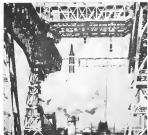
seas to the trackless depths of the sea.

Lockheed's Missiles and Space Division is POLARIS Missile System manager and prime contractor—leader of an industrial team that includes Aerojet-General, General Electric, Westinghouse, and hundreds of other contractors and suppliers, large and small. Close cooperation has brought the Polaris from blueprint to hardware in record time.

This new combination of nuclear submarine and Polaris missile will round out the nation's arsenal and give us the flexibility we need for adequate defense.



POLARIS is much smaller than other U.S. ballistic missiles of the 1960s, thanks to new miniaturization techniques developed by Lockheed scientists. This permits single nuclear submarine to carry 16 missiles.



"Operation Day-Catch" is apt name for this huge overboard recovery. It catches Polaris test vehicles in mid-air after test launchings, with permits to capture and analyze them for performance, instrumentation readings, data on air time and tracking development. Tests are conducted jointly by U. S. Navy, Westinghouse, and Lockheed.



4,000-crew test launch in the Santa Cruz Mountains of California is where Lockheed's Missiles and Space Division puts completed Polaris missiles through simulated flight test, over the pre-launch and guidance systems before actual flight of development vehicles.

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Pacific Regulator's wire, often as long as 100 feet, can be used in special cables for remote control operation on the X-15. For good reason: 100 Hyperbolic speeds, not even an fraction to heat surfaces in 1900 ft. at seconds. LDX drops inlets to liquid form of -180°F. Cold refrigerated air flows through wing and fuselage slots.

Each long-range structure, cable, model, drawing, expansion, differential, internal, external, and control cables. These systems must be compensated for in the control of the X-15. In remote drive from space, becoming too fast or slow. And each Pacific Cable Regulator is proven to be accurate in its own right.

Pacific Regulator's composite for thermal or mechanical expansion in control systems in space is designed to meet. They have internal cables of a unit, even when moving, insure control response.

Pacific Regulator also remote control cables at a lower level, thus reducing the friction that could break, break, control connection. Pacific Regulator is in use on all types of aircraft from light to heavy, or in the laboratory. There is no switch for their versatility. For complete information write Pacific today.

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Electronic Development and Manufacturing in Electronic Controls Dept.



control the American or British design. In fact, there is a substantial difference. The price paid for the Mi-45, regardless of whether or not it represents the official construction of the helicopter was comparable to the price of a Westland Whirlwind, the British equivalent of the Sikorski HO4S. But for the same amount of money the operators believe they get 30% more, sometimes even 50% more, in terms of sophisticated attitude to handle better the load of landing around them in rough air, which the Mi-45 starts lifting loads out of the high winds does to the school vans.

Constructing Details

Purchase of the Mi-45 was made by a Vienna airport-transport house, Scheller & Co., which has been doing business with the Russians in several ways, but not helicopters for about five years. In that Scheller's experience in negotiating with the Russians helped him as a natural for the job, which was the result of a direct conversation he had with one of the operators of the hotel industry.

Contract negotiated earlier by Scheller for machine tools and other equipment was, not to the letter in the Russian, he told Aviation Week. "If you have something specific in a matter, the Russian knows it," Scheller said.

Final negotiations in Moscow were made by Scheller and his brother-in-law, who is a specialist of Russians on the other including three top technicians from the Mi-6 group, an Aeroflot executive, and a technical representative from the Russian ministry of transport.

Russians guaranteed delivery within four and a half months of placing the order. In fact it was delivered within three. Included in the purchase price were two sets of spare parts enough to maintain a fleet of 10 helicopters, the necessary special tools, technical assistance and instruction.

The Russians also guaranteed 24-hour service on parts or components via Aero Bus, and also, under the terms of the contract, to solve special problems.

The value of the 34-chapter ASH-30V gyrocopter was guaranteed level of 600 to between 600 and 800 dollars for the helicopter was not furnished, particularly because of this, but they supply too specifically to the Aeroflot operation and would not be applicable to an independent foreign operator.

One figure supplied was the total consumption of the engine, given as about 75 gph. The value would show, but for an engine with a mean horsepower of 1070 a more exact figure is about twice that.

This specific model of the Mi-45 design.

is basically a general purpose, version based on the original model, rather than the transport Mi-6, seen in use on Aeroflot flights. Mi-45 was built for the purchase of the Mi-45 was that the operators wanted a helicopter versatile enough to handle passengers in the cabin or sling loads, and not otherwise. This wanted to be able to keep the utilization high during all seasons in terms of lifting supplies up to timber camps and out timber down from the hills.

There are such major differences in layout between this version and the standard transport. The Mi-45 has two round windows, far wide instead of the rectangular glazing of the transport. The machine also has built-in landing skids with wings, and a canard side window, passenger door. The Mi-45 has the side door. A cargo hook is a bare structural part of the Mi-45.

The helicopter differs also from actual models of the Mi-45 version, which have a passenger compartment that bulges the main floor in a deep belly shape. Lack of this feature gives the Mi-45 a spindly-legged look.

The use of the Mi-45 seems to be restricted by the Russian color scheme, red-a dark gray body, with a light cream colored top. Red and blue "lightning" accents have been painted on its head between guide lines drawn on the fuselage in general. Registration is carried in the upper fuselage, instead of on the tail boom as is practice in Russia.

First Walkaround

A first walk-around shows that the Russians have adopted English as the language for all important matters. In most cases the English is perfect, but a certain undercurrent, with the above said led to a few counterintuitive Russian translations from the Russian. For example, the oil cooler filter rack is labeled "OIL" meaning one of the oil cooler sections.

Only visible Russian lettering on the helicopter besides the registration-GCCP 31540-is on the blades, which are marked with numbers and dipping numbers with Russian letters as a prefix. Data stamp on the blades shows they were manufactured July 15 this year. What is probably the factory serial number-0883-is stenciled at the joint between boom and fuselage.

Aeroflot engineers and ground technicians are impressed with the overall mechanical design of the Mi-45 helicopter, and so that it is "wholesome," which translates freely as "durable."

The overall impression is one of efficient workmanship on critical parts, powerplants, base structure and other vital areas. The structure itself is obviously robust. Manufacturing techniques



POWERPLANT SECTION is highly accessible and has many binged or transverse access points. Color coding on the powerplant bay is clear with green and other basic colors. Engine exhaust system is coated with a corrosion material. Tanks are coded with numbers.



Mi-45 has one chock door with ramp and a conventional side fuselage passenger door. There is a window of "no-try" area on the helicopter. Body is dark gray, top is cream.



Pedigree of a Hound Dog

The guidance and control system of America's **NOVENO DDC** missile—best of breed—has a pedigree 13 years long. Created by Autonetics, the **NOVENO DDC**'s inertial autonomous system sends this super sonic air-to-surface missile from mother-ship to target anywhere in the world, in *any* weather. Equipped with an irrefragable series, **NOVENO DDC** extends the retaliatory effectiveness of SAC's B-52c bombers by hundreds of miles.

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or conventional. Folding is clean, straight and with no visible strainlines. Only in some areas is there evidence of sloppy workmanship and these are not in primary structure. Two examples which stand out are the 19.5 in. forward fuselage cooling ductwork and a small air duct grill underneath the tail cone boxes.

For example for the N5-B is a two row, 14-cylinder A65-SIV piston engine with two-stage supercharger, mounted in this case so that its crankshaft is on a slant upward and toward the rotor gear. This is conventional layout used in the U.S. and England for this type of helicopters.

Continuous cruise power at the engine is 3,070 bhp at 2,200 rpm. For takeoff and other maximum performance areas, the five minute rating is 1,700 bhp at 2,500 rpm. Emergency rating is a full 2,000 bhp at 1,000 rpm.

Standard tankage of the N5-B stores less 204 gal. capacity, but this model has an additional 112-gal. capacity in an auxiliary tank, for a maximum fuel load of 396 gal.

Rotor diameter of the N5-B is approximately 69 ft. The four blades are entirely fabric covered, with the exception of a couple of inches at the leading edge which is metal. The blades have a built in alcohol delisting system with an icing warning indicator tied to temperature and humidity gauging in the cockpit.

Each blade has a fixed trim tab at about two thirds the diameter. Rubber flaps are let into the fabric covering along the trailing edge at several points, presumably to take the stress on the fabric covering and keep it from ripping. One of the mechanics spent a precarious half hour before the flight standing on a rubber work platform and an old chair to fabricate these flaps.

Maintenance Design

The N5-B shows more signs of design for ease maintenance. There are large numbers of removable access panels in the main fuselage, and an absolute minimum of tie-down straps. In fact, there was not a single strand among "No Stow" on the entire aircraft. Two mechanics working on the rotor hub walked anywhere on the upper deck structure around the mast. Two fork trucks, shaped like towel racks, are on each fuselage side, but the windowsills and the top of the lateral air scoops were also used by the mechanics in steps without any ill effects showing.

Color coding in the post-exploded bay is done with a bright amount of paint with extra lines colored instead of simply marked with tape as is the practice in the West. Engine exhaust system is coated with a ceramic material colored dark green, similar to standard coatings used in the U.S.

Two large canvas covers containing all the special tools for maintenance or overhaul were spread out on the work tables. There were an estimated 80,000 tools, all of good quality and all properly coded with legible numbers.

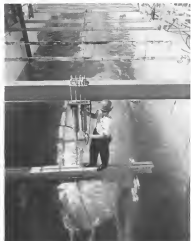
The N5-B was delivered from Russia and shipped up the Danube river. It had been packed for shipping with extreme care, as the Russians, with even part protected individually against corrosion. The rotor blades were taken off but otherwise the helicopter was completely assembled. Shipping cargo was properly weatherproofed with desiccating agents inside for further protection of parts.

Attachment of rotor blades to the hub was each done after the big helicopter arrived here, and the engine and rotor system were run on the ground for the usual check-out. At the time of

ARRIVAL HERE, 1962, the helicopter had about seven hours' total time on the rotor system.

At 10 o'clock that morning, the helicopter landed as if it wouldn't fly for a week. But by 11 a.m., when Kapustin and the two American pilots arrived, the craft was being hoisted up and towed down. One interesting sidelight: The Russian mechanics were very persistent in their work and wanted the Soviet helicopter to look good. One of them kept pointing out areas of oil or smudges of dirt on the fuselage that were to be wiped off by the visiting American. American mechanics working alongside the Russians.

The helicopter was checked for flight about noon, and by then the field had closed in to about one kilometer visibility and perhaps a 50-ft. ceiling. Kapustin and a Russian mechanic



Convair 880 Fuselage Undergoes Tonk Tests

Convair 880 transport fuselage is suspended by steel wires in water tank at Convair Division of General Dynamics Corp. at San Diego, Calif. Fuselage has been subjected to 36,000 penetration cycles in five months. Test sequence is adjusting one of the main that pull upward and downward on strengthened fuselage to simulate operational stresses.

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grubbed the tail hammer, the rest of the ground crew pulled where there was a handle, and together they, man-handled the Mi-45 out of the hangar, across the apron and up a slight incline to a closed area.

The mechanic climbed aboard and went through a quick check of controls, sliding the blades through their full angular deflection range with the collective pitch control. Then Kapehina and Beederman took over as pilot and copilot.

The ASH62V engine fired, belching gray clouds of wet exhaust fumes over the apron. A microphone held a long pole with a battery control lamp on one end to engage each rotor blade individually and pull it forward against what was about each a step in the rotor lock system somewhere. When he completed this for the fourth blade, the rotor started to rotate very slowly and continued this rotation during engine warm up.

With engine revved up to full power, Kapehina engaged the rotor system and the drooping blades began to whirl, accelerating rather more rapidly than other types familiar to the observer. A dust run with water at one end followed by disengagement of the rotor, which slowed and then continued to drift while the engine was idling. Mechanism checked into and out of the helicopter and then, with most of the ground crew back on the ground, Kapehina again revved up the engine, engaged the rotor, held it at idling rpm for a few seconds, and increased the collective pitch for the blades.

The Mi-45 lifted off nose-high and a tail windward, backed up a few feet and then held at about 10 ft off the ground for a few minutes of loitering. Wind was about 15 mph, driving a light rain before it, it was not gusty, but the Mi-45 seemed to be hovering as steadily as if there were sharp gusts.

From the low altitude the helicopter rose to about 50 ft and held there for several minutes, hovering and backing, once or twice rotating about its vertical axis at a low rate. Then Kapehina flew over the apron to a point near the control tower about a quarter mile away and proceeded to do a series of vertical landings and takeoffs out of hovering at less than 100 ft.

This was followed by a landing on the runway, and a long motorcade speed taking up and down the length of the field. At one point the helicopter was stopped at the middle of the meadow and everybody got out, huddled under the tail boom for a while and then got back in to repeat the lengthy taxiing routine again.

During all the takeoffs, the lift was heavy and noisy. It was not possible to observe which pilot was handling the airplane, although Kapehina had definitely made the first lift-off.

Total rotor time during the observation was about two hours, bringing the time of the machine up to about 10 hr.

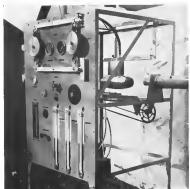
The stall performance of the Mi-45 will not be known until the cost operational figures are in, and the Russians have brought together, for comparison, and make have traded figures with the Austrian Air Force now operating a fleet of Westland Whirlwinds. That an analysis of the test run at the Mi-45 is some time off in the future.

But the real significance of the Austrian purchase is that it marks the entrance of the Russians into the commercial aircraft market in a serious way. The contract, the preparation of the helicopter for shipping, the complete documentation furnished with the craft, the construction of tailored airport and training the presence of the top heli-

copter pilot in the USSR, all point to a studied effort on the part of the Russians to shed and best Western allies.

Consequently this single sale of a helicopter to a small operator has great implications. Nobody believes that in a one-time effort to gain prestige or to test the experiment of selling to the West. Most European observers who know about this position are inclined to agree that it is a serious start by the Russians in a field they have neglected up to now.

And knowing the past performance of the Russians in other commercial fields, they agree that the effort will bring more and more of such trading and plant the Russian aircraft industry in a strong competitive position with respect to its European and American counterparts.



RAMJET test stand shows throat measuring linkage, closed-down, water-cooled probe position indicator and actuators.

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The engine is 5 in. in diameter. 15

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F26	.26	5.1	7000	16.5	281	10000	32.5	284	2.68	4.05	
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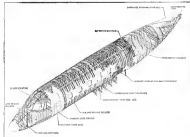
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power supplied by a small dry battery. The complete installation has been specially developed for rotational speeds from a rig used for a turbocharger to propeller experimental programs. Cost of the unit is \$16,000 and the first equipment has been installed in London's Imperial College.



Lockheed JetStar Headed for Stress Tests

First production fuselage of Lockheed JetStar turboprop transport is lifted down its main assembly jig for transfer to static testing facility at Marietta, Ga. Plane is assembled in a single 52 ft. long jig (over all plane length is 60 ft. 61 in.). Engineering surfaces include use of computerized load map to support only through frames in place of fuselage (see below). Base shell system of center fuselage is one piece of 11 segments integral to forward metal channel section rings. Skoop truss system are limited to 12,000 psi due to materials operating under pressure. Skin tests include subjecting fuselage to pressurization of 13.7 psi and simulated 5.6 in. per hour rainfalls.



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British Accident Investigation Reports

Debris Jams Elevator Control, Leading to Crash of Transport

(Following is a report to the British Minister of Transport and Civil Aviation by J. W. Rogers, deputy chief inspector of accidents into the circumstances of the accident involving a *Boeing 747-200* G-ALPH, which occurred Apr. 1, 1976, at Heathrow, London, England. All three crew members were killed; the aircraft carried no passengers.)

The aircraft was on a routine test flight 10 minutes after takeoff from the Air Traffic Control office at Heathrow when a radio transmission from the aircraft in which the second pilot, and that the controls were jammed. Witnesses observed the aircraft descending in a series of dives and climbs until it crashed and caught fire.

THE AIRCRAFT

The aircraft was constructed in 1970 and first registered in the name of British Overseas Airways Corp. It was registered in the name of Skyways Ltd. in February, 1975. A Certificate of Airworthiness was issued in September, 1975, and was valid at the time of the accident. The aircraft had been maintained in accordance with an approved maintenance schedule, from the last check 4 months in February, 1975; the aircraft had flown 2,526 hr. and 200 hr. since the last check 3 months in February, 1975.

A check 3 inspection was completed on Mar. 31, 1976, and during the inspection No. 2 and 4 engines were changed. The cause of the change of engine No. 4 at test was they required in accordance with engine producer. The aircraft was certified as

fit for flight at 1,000 hr. on the day of the accident.

The aircraft had flown a total of 12,697 hr. of which 3,384 were flown by Skyways Ltd. The calculated weight at accident was 61,621 lb. and the center of gravity was within the prescribed limits. The maximum authorized weight of the aircraft was 65,000 lb.

THE CREW

Capt. G. D. Bennett was in command and was acting as pilot-in-command when the aircraft took off. He was 31 years of age and held a valid *Boeing 747-200* Pilot's License issued in Group 1 for *Boeing 747-200*. His flying time amounted to 10,371 hr. of which 7,587 were in *Boeing 747-200* aircraft. He had been employed by Skyways Ltd. since April, 1969 and at the time of the accident was the company's chief test pilot and senior check pilot.

Capt. J. A. West was 35 and held a valid *Boeing 747-200* Pilot's License with an endorsement in Group 1 for *Boeing 747-200*. His flying time amounted to 7,477 hr. of which 744 were in *Boeing 747-200*. He had been employed by Skyways Ltd. since April, 1973 and was presented as captain on August the next year. When the accident took off Capt. West was acting as second pilot.

Engineer Officer M. Drury was 35 and held a valid flight engineer's license issued for *Boeing 747-200*.

The weather was fine and had no bearing on the cause of the accident.

The aircraft took off on a test flight from Heathrow Airport at 10:10 and cleared steeply toward the northwest. A few minutes later it was observed approaching the airport from the west at a height of approximately 1,500 ft.

At 10:15 the Air Traffic Control Tower received a radio call in which Capt. West declared an emergency and that the controls were jammed. HAF's master later told that the controls were completely jammed and that the aircraft was about to hit the ground.

About the same time the aircraft was seen to be in a series of dives and climbs. It crashed in a field and the crew was killed.

The greater part of the wreckage was destroyed by fire.

Inspection of the scene of the accident showed that the aircraft had struck the ground on a heading of 910 deg. magnetic while descending at an angle of approximately 18 deg.

The wreckage had extended over a distance of approximately 300 ft. The fuselage had broken at the center section and that part containing the flight deck had broken through into 150 ft. The port wing had broken into all five engines had broken away and apart from the engine the wreckage had been severely bent. An examination of the control area in the fuselage and on the flight deck for signs of jamming was without result.

INSPECTIONS

A check of between 130 and 157 ft. at the control ledge attachment point is equivalent to a force of 15 to 60 lb. at the aperture of the pilot's control column. As the master found on the distance from the accident area deeper and more extensive it must be supposed that they were caused by the application of a greater force than



Scavengers Strip Down DC-3

Thorough job of stripping a stricken aircraft by scavenger forces is shown in these two pictures of a *Boeing 747-200* DC-3 that crashed near Charleston, Va., on Oct. 30. Picture at left, showing full assembly and the section of the fuselage, was taken Nov. 9. All that remained of the section of the aircraft after scavengers had worked on it is shown in the second picture taken approximately five weeks later on Dec. 3. Site of the accident is in thick wooded mountainside area accessible only after a 1½ hr. uphill hike.

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that produced in the laboratory. It is reasonable to suppose that it was within the capabilities of the pilots to apply enough effort to free the object which caused the crash, made on the down turn between the nearest components and to move the controls in some critical. The resistance of the ground components to movement would cause suddenly when the aircraft approached the normal position and the locking slots in the down turn and the locking latch bearing came into alignment. It is unlikely that the pilots could be able to integrate this and avoid over-rotation and pressing on the other side of the slot.

It is evident from the appearance of the slot marks that several such moments did take place. The lowest scoring was undoubtedly resulted from the progressive deterioration of the object causing the peeling and it is reasonable to deduce that the force required to move the aircraft down in clearance was less than the pilot could exert.

The difficulty of keeping the aircraft from excessive rotation is something that designers and operators have always been aware of in the structure of aircraft in such that small objects can find their way into crevices and inaccessible places. The nature of gusting against the happening and the instant loss of stability, therefore, cannot be emphasized too strongly.

CONCLUSIONS

1. The documentation of the aircraft was in order.
2. The gross angle was below the action and maximum and the loss was within the prescribed limits.
3. The crew was competent and properly trained.

4. The clearances of the aircrafts were, indeed, as the result of finding of the elevator mechanism by a small extraneous object which was not found.

It is not possible to identify the object or to say how it caused the aircraft.

The aircraft, as it appeared to a side with working features where the control was shown in its down frame, by a small object. Deep bright spots which reflected on the face at the point where down turn adjacent to the locking latch bearing which are normally and fixed parts of the elevator control system. The appearance of these marks under microscopic examination indicated that a hard object with a small flat end had landed and penetrated the mechanism. Judging by the depth and width of the score marks it was clear that considerable force had been applied to operate the elevator controls. The object appeared to show, in spite of its cylindrical shape, was not found and it is presumed that it was deflected when the aircraft struck the ground.

Several small extraneous objects were, however, recovered from the area below the aircraft. Inspection of the area below the aircraft, but of neither of the two frames in which was carried out and a number of small marks of extraneous objects was found. The attention of the flight inspection department and the Air Inspection Board incident aircraft was drawn to the matter at once. Experiments were carried out on a Hercules aircraft in which a piece of 14 gage brass wire was introduced into the appropriate

part of the control mechanism and as a result was made to assist the elevator controls from the cockpit. It was found that this could be carried out with the greatest difficulty. Laboratory examination of elevator down turn in takes from the cockpit would show that the elevator mechanism of the aircraft this among the more serious on one side of the landing gear indicating that some of these marks were of a greater size. The marks of some of the objects were reported on the aircraft. The appearance of the appropriate score marks indicated that they were made on the same occasion or those on the other side of the landing gear where there is no evidence of pressure scoring. There is, however, no record of any previous actions or pressing of controls. Similar but different and less serious marks were reported on the standard side elevator down turn of the same aircraft control unit in a laboratory experiment.

A test was carried out to show that the test rig could approach and the down turn operated by a block, lead applied to the control linkage attachment point. This lead was connected across a rock. A wire was split into two introduced between the down turn and the back housing. It was found that the split gap could be found between the two control linkages. The test of a lead of between 110 and 115 lb and that considerable force was necessary to enter the down turn in its normal position. This force could not be achieved because the testing mechanism was not over sized but it is considered that it was in the order of 100 pounds more than 110 lb. The second of the pressure when the aircraft was tested had could not have due to the split pin bushes and progressively increased the force, necessary to move the down turn. The down turn was removed from the unit and an examination of the score produced showed there to be a lead lower but very similar to those on the port side down turn.

The accident was caused by the elevator mechanism becoming jammed. This occurred the pilot of control of the aircraft. The pressure was due to the presence of a small extraneous object which entered the control mechanism.

W. G. Gosses
Deputy Chief Inspector of Accidents

FAA Plans to Designate Pilot Medical Examiners

Federal Aviation Agency proposes to require applicants for student, private pilot certificates to accept medical examinations from designated examiners. The FAA will hold an informal public hearing Jan. 14 in Washington, D.C., to get persons an opportunity to express opinions on the proposal.

Any competent, licensed physician can now give a physical examination to student and private pilot applicants—practices that have been the province of designated medical examiners during World War II. The number of examiners could now be increased in different geographical areas to give the examinations without unnecessary travel costs to applicants, FAA says.

FINANCIAL

Chance Vought Enters Mobile Homes Field

Dallas, Tex.—Chance Vought Aircraft Corp. is entering a national division two-manufacturing setup in pushing its entry into the U.S. trailer homes market (AW Dec. 14 p. 35). New venture is another indication of the company's diversification program (AW Dec. 26 p. 125).

The company acquired by stock purchase, its large mobile home firm and signed a purchase agreement with a third. It will operate the plant through a wholly owned subsidiary, Vought Industries, Inc. The acquisition of General Coach Works, Market, Mo. and ABC Coach Co., Chicago, Ill. It also has signed a purchase agreement with Midstates Corp., Ruston, Ark.

The three firms, which operate more than a dozen facilities, last year produced a total of more than 500 trailers.

Vought Industries, Inc., which will be under the direction of Clifford B. Bart, formerly vice president of Chance Vought Aircraft Corp., is headquartered in Dallas. Manufacturing of mobile homes will continue at present facilities of the new acquisition and there are no plans to bring on into the aircraft facilities, it was said.

Bart indicated that Vought Industries is considering a broad long-range expansion of its new acquisition.

Among other steps under consideration, he said, are establishment of a nationwide system of centralized manufacturing facilities to coordinate the present production of high transportation cars, a national marketing and distribution system, and selective planning of product development to provide a wider diversified product line, including all types of trailers.

Also discussed are intensified engineering and research plans for deeper market penetration, national advertising programs led by the dealer organizations and materials and service programs.

Two British Groups Study Merger Plan

London—Stock exchange offer made by the Hawker Siddeley Group, Ltd., for the Blackburn Group will be one of the biggest aircraft industry mergers to be carried out in the country so far.

Terms of the offer are Hawker Siddeley ordinary shares (50.00) for each of the 2,750,456 ordinary shares (51.00) in Blackburn. Additionally, special dividend of 14 cents per share will be paid to Blackburn shareholders out of

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\$17.5 million from the previous year's \$14.5 million. Of the net \$5.8 million came from the Group's Canadian operations—A. V. Roe (Canada) and Deane Steel and Coal Corp.—and the remaining \$14.1 million from U.K. operations.

Packard Bell Electronics Corp. achieved record sales of \$46,688,862 in the fiscal year ended Sept. 30, compared with fiscal 1978 sales of \$37,371,881. Profit also set a record—\$11,379,140 for fiscal 1979, compared with the previous year's \$1,083,994. Net income was \$1.75 a share on 792,608 shares outstanding for the 1979 fiscal year. Last year it was \$1.46 a share on 676,000 shares.

Sevenson-Chambers, Inc., had a net loss of \$249,000 for the three quarters ended Sept. 30 and net sales of \$16,316,000. During the first nine months of 1979, Sevenson-Chambers made a net profit of \$104,000 on net sales of \$15,551,000. Net loss was \$2,000 for the quarter ended Sept. 30, on net sales of \$1,673,000.

Aermap, Corp., net earnings were a record \$2,713,240 for the fiscal year ended Sept. 30 and represented a 28% increase over fiscal 1978 earnings of \$2,045,458. This year's earnings equaled \$2.27 a share on 1,194,135 common shares outstanding. Last year's earnings were 75 cents a share on 1,158,944 shares, a 70 stock dividend paid in 1979 is taken into account. Net sales for fiscal 1979 were \$48,732,457 compared with \$35,086,970 for the previous fiscal year.

Sales of \$6,070,000 of business aircraft in November gave Bell Helicopter Corp. its biggest dollar volume month for business aircraft in its history, compared with \$5,846,000 for the same period last year. For the first two months of its 1980 fiscal year (October-November), Bell sold \$6,081,000 worth of business aircraft compared with \$5,806,000 for the same period last year. Volume is based on revenues for period, including spread equipment.

Contracts totaling \$26 million for Bell HU-1A turboprop helicopter follow its production and development of a new HU-1B have been received by the company from Air Force which announced the program for the U.S. Army. HU-1A production was suspended through 1961. HU-1B is fitted with a Lycoming T55-L-5 turboprop and new turbine components, permitting an increase in shaft horsepower to 1,300 hp, compared with the HU-1A's 1,151-LA, which delivers 720 hp. Later model also has wider chord main rotor

blades, increasing disk velocity. Turboprop version of HU-1B carries eight gun pilot and copilot.

Net earnings of Bessell International Airways for first nine months of 1979 were \$2,186,271, or 71 cents per share, up 41.2% over the same period last year. Earnings compared \$1,831,016 from operations, compared with \$1,206,803 last year, and \$273,375 from sale of surplus equipment compared to \$295,849 in the first nine months of 1978. Season load factor for the nine-month period increased from 56.76% to 58.55%. Revenue plane miles decreased 1,049% from the 1978 period, but taxable net miles operated increased 4.82%, revenue passenger miles 5.15% and tonmiles 12.97%, express ton miles 21,007% and airfreight tonmiles 23.46%, including reductions, of the new Lockheed Electra turboprop equipment.

Middle Systems Corp., Los Angeles (AVI Oct. 28, p. 127), reported consolidated earnings of \$104,351 or 36 cents per share on 316,813 shares of common stock outstanding for the six months ended Oct. 31. Consolidated sales for the period were \$675,116. Earnings rose from \$103,794 on April 30 to \$1,845,918 on Oct. 31, a 1,749% increase.

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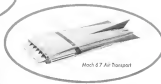
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Infrared Systems studies; and Solar Radiation studies. This work is expanded program into the total concept of flight creates urgent need for personnel with high-level skills. The concept ranges from subsonic to hypersonic speeds, from atmospheric to outer space vehicles. High-skill technicians and engineers are invited to take advantage of this need, to investigate the many career opportunities Lockheed offers.

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Tank Corp., 1009 E. Vermont Ave., Anaheim, Calif.

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Aeropedic-General Corp., Structural Plastics Division, Azusa, Calif.



Boeing Develops Starter for Swissair

Panasonic starter system developed by Boeing Airplane Co. is featured Products Division for Swissair to built around a Boeing jet turbine on the power source, system delivers about 120 hp/rev of air at a pressure of about 45 psi and temperatures up to about 4000°K. It will be used by the airline for starting turbine-powered aircraft at Zurich, Kloten, Geneva, Cochin, Rome, Lisbon and New York International airports. The unit shown is the first of seven ordered from Boeing and is mounted in a General Ford Taurus panel truck. Six smaller starters have been ordered by Swissair from Auto Electric, Ltd., of Uxbridge, England, built around that company's system.



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Symetec, Inc., 3380 Airport Ave., Santa Monica, Calif.

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Tape recorder to be carried on the Transit Mercury communications flights weighs 12 lb and has 4,500 ft of magnetic tape.

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Consolidated Electrodynamics Corp., 100 N. Sierra Madre Villa, Pasadena, Calif.

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aid. Qualified engineers should communicate their interest in any of these top positions to Employment Manager, Mr. Melvin Vobach, Boeing Airplane Co., Department N16, Wichita 1, Kans.



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WHO'S WHERE

(Continued from page 23)

Changes

A. G. Ziegler, chief engineer, Douglas Aircraft Co., Tulsa, Okla., Durand and E. S. Matlock, assistant chief engineer.

Samuel Rossmo, manager of the newly formed Undersea Warfare Group of the Advanced Development Laboratory, Avondale Division of A. Industries, Inc., Phoenix.

James G. Wilkins, manager, Radioelectric Department, Radio Pacific Division of RCA, Avondale Corp., North Hollywood, Calif. Michael Kaufman, director of engineering, Radio Instruments, a division of Radio Manufacturing Co., Santa Monica.

Rae K. Anderson, chief engineer, Deane and Margolin, Inc., Olathe, Mo. Dr. Nieme A. Eshelbourn, assistant vice president and director of research, Strong Corbin Division of General Dynamics Corp., Rockville, Md.

George M. Robertson has been appointed assistant for administration on the staff of the vice president of Chrysler and manager of Chrysler (Automotive) Division, General Dynamics Corp., San Diego, Calif.

William C. Ray, responsible for general aviation sales, Transportation Division of Altek Corp., a subsidiary of Collins Radio Co., Richardson, Tex., and Victor J. Hensok, responsible for commercial aviation sales and flight operations.

Hedert L. Chaworth, systems director, DataTape Division, Consolidated Electronics Corp., Pasadena, Calif.

Dr. Robert A. Bader, a principal consultant and head of the vacuum machine group, Space Defense Systems Division, Electro Optical Systems, Inc., Pasadena, Calif.

David S. Ward, manager of customer service, FrostMcCallough, Inc., San Carlos, Calif.

W. Edward Bouglous, formerly director of public relations for Toys World, has been named J. Walter Thompson Co. as a public relations supervisor and group head.

Richard C. Papp, manager of the newly established Birmingham, Ala., field office of Automotive Division of Ford Motor Co. Also Miles G. Woldman, assistant manager of Automotive Eastern Regional Office, Washington, D. C.

Frank N. McDuffie, technical coordinator at the Ames Research, Menlo Park, Calif., Mo. for General Precision Equipment Corp.

John A. Redman, manager communications and space projects, Houston Petroleum Corp., Los Angeles, Calif. Also John N. McDonald, manager, Contracts Dept. Hercules Powder Co. a Chemical Products Division, Wilmington, Del. In an assumed the appointment of the following outlet and create personnel specialists to the scientific staff of the Plant and Process Group, Avondale E. Chrysler, William D. Kuhn, E. and John A. Schmitt.

Douglas M. Caplan, assistant congressional liaison officer, Office of Congressional Liaison, The Federal Aviation Agency, Washington, D. C.

Paul A. Eng, mechanical engineering manager, West Coast Division, Los Angeles, Calif., of Volition Electronics Corporation for Altek's De West Laboratories, Inc.

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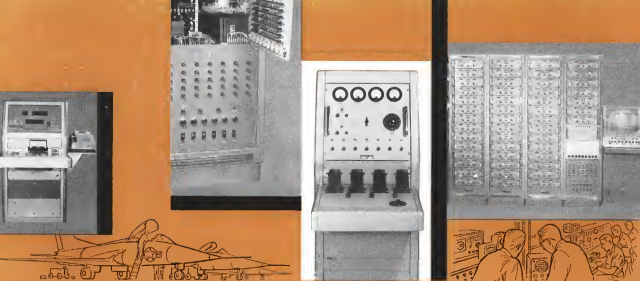
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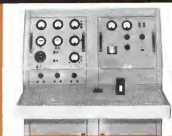
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